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NEW YORK BUSINESS MEN'S CONFERENCE.

A conference of business interests representing the various boroughs of Greater New York, for the purpose of taking action on behalf of the commerce of the port and state of New York, was held Aug. 5.

The conference organized by the election of Albert E. Henschel as president; David J. Tyson, vice president, and Frederick C. Zobel, secretary.

After an address by the chair, a general discussion ensued, in which all the members took part. A resolution was passed defining the objects of the conference, as follows:

"To ascertain and consider the chief causes responsible for the persistent decline in our commerce; and in order to confer intelligently concerning the same, to make investigations, invite and hear representatives of the various branches of commerce, trade and industry, to the end that the underlying causes of New York's commercial decline may be truly ascertained and suitable steps taken, by securing legislation and otherwise, to prevent the decline and promote the growth of our commerce so necessary to the commercial prosperity of the Empire State and Greater New York."

The meeting adjourned to meet in two weeks at an hour and place to be fixed by the chair.

Mr. Albert E. Henschel, on taking the chair, said: "We are assembled to lay the foundation of a movement whose potentiality for good can neither be fully estimated nor foreseen. We are here to consider the causes that have brought about the decline of the commerce of New York, with all its deplorable consequences, and to do what we can, with the weapons of truth and an enlightened public opinion, to remove the barriers that stand in the way of our commercial prosperity. For more than thirty years warnings have been uttered, but very little has been done. The one bright spot in our commercial firmament is the new barge canal, authorized five years ago; but even under speediest construction that great work will take years to finish; in the meantime something must be done to save what remains of our commerce, which is being drawn and driven to rival ports on the Atlantic seaboard and the Gulf.

"We are now witnessing the spectacle of the shipping interest of the Atlantic seaboard on its knees before the Trunk Line Association, praying American rail roads for rates which shall not entirely divert American commerce to the foreign port of Montreal. It will be seen from the following statement of the receipts and exports of wheat for the week ending July 18, 1908, at the ports of Montreal Baltimore, Philadelphia and New York that in both items of receipts and exports, Montreal not only leads, but comes up almost to the figures of all these other ports put together, and that New York lamentably lags behind—the last in the race.

	Receipts.	Exports.
Baltimore	406,684	310,000
Philadelphia	393,991	162,333
New York	344,200	101,321
Total	1,144,874	573,654
Montreal	910,221	498,386
	234,654	75,268

"Of first importance in the warfare upon our commerce is the differential. In showing its purport I cannot do better than to quote the late Simon Sterne, who made the subject a life study and who maintained a heroic struggle to secure economic justice for the people of New York. Mr. Sterne said:

"'The contention that an arrangement which places New York on an equality with other cities is not discriminative against New York, because New York, as Mr. Vanderbilt thinks, has no right to superiority, must be conceded to be pure and simple nonsense. To level, by artificial regulations, a corporation, person or city, having certain natural or acquired advantages, down to the place of its rivals, is to discriminate most injuriously against the one having the advantages.'

"Statistics show a persistent decline in the percentage of New York's commerce. In 1873 New York handled 78 per cent of the flour, wheat and corn exported through the Atlantic seaports and in 1901 it was less than 31 per cent.

"This showing justifies Mr. Sterne, proving as it does that the differential does not preserve a parity in the relative commercial development of the ports in question, but works most inequitably against New York's interests.

"The power to lay such subtle and arbitrary tax as is involved in the differential upon the commerce of a community is a plenary power to regulate commerce; a power which is by the constitution of the United States vested in Congress and denied to the States; if, in exceptional cases, the exigencies of the transportation problem seem to require solution by the use of such power, it should be exercised only in accordance with the constitution under strictest governmental control, to the end that communities and individuals may not be subjected to the arbitrary will, judgment or caprice of an irresponsible power.

"How serious is the effect of this discrimination, when we find that merchants in Chicago, St. Louis and other Western cities can obtain merchandise from European ports at cheaper rates than our railroads charge from New York to these same cities.

"New York's aggressive competitors have not only appropriated an important part of New York's commerce, which arbitrary railroad freight discriminations have thrust in their way, but they have been schrewd to exploit their advantage

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by affording practically a free port, equipped with excellent terminal facilities, free from the annoyances and exactions that have become a part of our commercial system here.

"Our difficulty is thus two-fold: First, the differentials imposed by our railroads, and, second, our failure to supply adequate means for the economical interchange of traffic between rail and water, coupled with exorbitant charges for dockage, wharfage, grain elevator, storage and compulsory pilotage; all of which conspire to make New York the dearest and least desirable port to do business in. How can we expect to retain our commerce under such conditions?

"Is it any wonder that our harbor is full of empty ships, lighters and other vessels, unable to secure outward cargoes? One group of lines has 20 ocean vessels tied up that have been in active service between New York and European ports, two other vessels of this line have been placed in the Australian service. Another shipping firm has 38 vessels out of commission, another has seven ships idle. The lighterage business of New York is at a standstill with acres of idle craft. Of canal boats there is little to be seen. As a direct result there are hundreds of thousands of people out of employment; this stagnation of business at our port extends not only throughout the length and breadth of this commonwealth, affecting every interest in the community, but affects likewise a large section of the Union. The Canadian port of Montreal on the other hand, is teeming with business. Canada has been laying plans for many years to divert to herself the trade tributary to us by a systematic improvement of her canal, railroad and terminal facilities, making Montreal a chief exporting and importing center, and practically a free port.

"New Yorkers have long been content to rely for commercial supremacy upon their past glory, and upon an antiquated ditch—the Erie Canal—that only permits boats of 6 ft. draught and has locks practically obsolete and of diminutive capacity, with horses and mules as motive power in this age of steam and electricity. Our paramount hope lies in the speedy construction of the new barge canal, which should be facilitated and encouraged by every means in our power.

"With a vicious differential in freight rates leveled against the welfare of New York by corporations deriving their charter life, sustenance and princely gifts and bounties from the people of New York—with excessive terminal charges at Chicago, Buffalo and New York, chief among which are the grain elevator charges—with the enormous and unconscionable wharfage, dockage, dock rentals, compulsory pilotage and kindred exactions at the port of New York and with a lack of proper terminal facilities, is it any wonder that our commerce is fast vanishing, and that all interests of every kind are made to suffer?

"In contemplating what needs to be done to bring the port of New York to the standard of modern equipments, we may hastily pass in review what some of the foreign countries have been doing in this respect, as described by Professor Haupt in an excellent article, published in 1905. The French republic has expended over $700,000,000 on her internal waterways, which are free of toll; Canada has spent $95,000,000; Manchester, $85,000,000. Belgium, but little larger than Vermont, has 1,300 miles of waterways, on which, together with its ports, has spent about $90,000,000. Russia is about to spend $700,000,000 on its railways, and as much on its canals. Germany, Austria, Italy and many other foreign countries are doing everything to bring their harbors and waterways to a high state of efficiency, while we Americans seem to neglect these arteries of trade and have only recently taken up a systematic study of the subject. The saddest chapter of all is the closing of our canals or their virtual disuse by reason of their absorption by competing railroads. In Pennsylvania, between 1865 and 1874, some 701 miles of canals, which had cost over $33,000,000, were abandoned. In a similar way, 656 miles of the Ohio canals were obliterated, having cost nearly $11,000,000. New York has lost 359 miles, which cost a little over $15,000,000.

"The closing of these valuable arteries of commerce is a crime against the interests of the community. Our energies should be directed to cause the reopening of these canals, to push the completion of the new barge canal and all other waterways, to prohibit or mitigate the railroad differential charges against the port and the State of New York, to improve our terminal facilities for the cheap and convenient handling, storage and transshipment of freight, to reduce port charges to a minimum, remove exactions and annoyances, and generally to put the city and state in a position where they may be on a parity with other communities in the competition for the world's commerce.

"If this can be done we shall retain our commercial supremacy, otherwise we must sink to the level of a third-rate city and state.

"Let us awaken the people whose vital interests we are endeavoring to subserve. By united effort we can yet turn the golden stream of commerce into its wonted channels and restore the teeming life and activity upon our bays, rivers, canals and railroads, fill up our vacant docks, stores and dwellings, and preserve for our people the inestimable opportunity to earn a living by trade and labor. We are engaged in a movement worthy of the care and attention of every patriot. There is none so rich and great that will not share its benefits, and none so poor and humble that will not feel its salutary influence. Let us proceed courageously with the work before us."

EARNINGS OF MANCHESTER SHIP CANAL.

The report of the directors of the Manchester Ship Canal Co. for the half year ended June 30, 1908, which was submitted to the meeting of shareholders held Aug. 6, was as follows:

The audited accounts for the half year show that the receipts on capital account amounted to £267,256 in respect of the issue of £350,000 4 per cent perpetual debenture stock. The expenditure out of capital was £85,879, but as the proceeds of sales of land amounted to £4,750, the net outlay was £81,129. The total expenditure on capital account amounted to £16,698,230, leaving a balance to credit of £245,716.

The ship canal revenue receipts amounted to £236,830, and the expenditure to £133,803, leaving a credit balance of £103,027. The profit of the Bridgewater department was £12,023. The balance carried to net revenue account was therefore £115,050, to which was added £469 balance, brought forward from last half-year's account, making a total of £115,519. After deducting £1,028, the debit on general interest account, there was an available balance of £114,491, which was distributed as follows: Interest upon the first and second mortgage debentures, £44,743; interest upon the 3½ and 4 per cent debenture stocks, £5,639; interest upon the mortgage of surplus lands, £1,000; rent of transit shed, Dock No. 8, £3,130; rent of Dock No. 9 and transit sheds, £12,500, and the remainder, £47,479 to the corporation of Manchester on account of interest on the debentures they hold.

V. Zuvich, New Orleans, La., has been awarded contract by the Merchants' & Growers' Transportation Co., of that city, for the construction of a gasoline freight and passenger boat for the lower Mississippi river trade. She will be 100 ft. long, 22 ft. beam and 6½ ft. depth of hold. She is to be fitted with a 125-H. P. Fairbanks-Morse gas engine. The craft is to operate twice weekly from New Orleans to Venice, La.

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IMPROVEMENT OF RED RIVER.

Capt. Clark S. Smith, United States engineer, with headquarters at Vicksburg, addressed the waterways convention on "Improvement of Red River." He said:

1.—Original conditions of Red river.

This river rises in the plain region of northwestern Texas and New Mexico, flows in an easterly direction between Texas on the right hand and Oklahoma and Indian Territory on the left bank, and enters Arkansas where it turns its course southeasterly, and flows across Louisiana into the Mississippi river.

When improvement was undertaken by the United States in 1828 a great raft, composed of logs, stumps, drift, etc., extended from Loggy bayou, 65 miles below Shreveport, to Hurricane Bluffs, 27 miles above, this covering a stretch of river 92 miles long. Numerous bayous flowed out from the river at various places and depleted the main channel; a notable instance of this condition being at Tones bayou, below Shreveport, where the amount of water taken threatened to close the main channel to navigation. At Alexandria the falls were impassable at low stages. Navigation was generally difficult and dangerous at all places and at all times. The channel shifted frequently and at flood stages the river overflowed the entire raft region. The banks were heavily timbered, and each flood caused them to cave or slide and to fill the river with snags and drift.

Between 1828 and 1841 more than $425.000 was appropriated for the removal of the great raft. A channel was opened through this obstruction, but owing to failure of appropriations between 1841 and 1852 additional rafts formed. In 1853, $100,000 was appropriated, and in 1857 the agent in charge reported the route open, but not completed, and recommended for appropriations of $50,000 a year for completion and maintenance. The total amount expended from 1828 to 1857 was over $500,000. Nothing further was done for fifteen years, and in that long interval the results of much of the former work were lost.

The project entered upon in 1872 contemplated opening navigation through the raft and closing Tones bayou outlet. Under the river and harbor act of 1878 the removal of wrecks, snags and other obstructions below Shreveport, was commenced, and the act of 1879 authorized the same kind of work above the raft, to Fulton, Ark.

Work was carried on under three distinct appropriations until 1882, when it was combined in a general appropriation for continuing the improvement from Fulton, Ark., to the Atchafalaya river, Louisiana, with a provision for work at Alexandria, La. The river and harbor acts of 1884 contained provisions for closing Sale and Murphy outlet, Louisiana. The acts of 1888, 1892 and 1894 authorized expenditures for the improvement of Cypress bayou and Bayou Dorcheat and Sulphur river, tributaries of Red river. The act of 1902 provided for improvement of the channel at Shreveport, La., and the act of 1905 contained a provision for the further improvement of the channel at Alexandria, La.

2. — Improvements made, and present condition of the river.

The following are the chief results from the expenditures of the foregoing appropriations.

The channel cleared through the great raft in 1872-73, opened to navigation 188 miles of river above Shreveport to Fulton. Subsequent work secured the complete removal of the raft, prevented reformations of the same nature, increased the width of the river 100 feet or more, and there now flows in the course laid out for it in the old raft region, a broad and deep river, safe for navigation at all but the lowest stages.

Fifteen years ago the survey showed that the low water line at head of the raft had lowered more than 15 feet since 1872, and that this change continued down stream through the raft region and gradually diminished to about 3 feet at Shreveport. The continual progressive scour is attaining a normal slope in that stretch. Incidentally, the removal of the raft drained the fertile valley and reclaimed thousands of acres of productive lands. Tones bayou outlet is closed by a heavy earthen dam, connected with the line of levee above and below it, and the main channel, for a time called "Little river," has widened and scoured, until navigation of the stretch is uninterrupted at low stages. All of the chief outlets along the right bank above the Tones bayou to the Louisiana-Arkansas line, 89 miles, have been closed with dams by co-operation with the state of Louisiana and local levee districts.

Work at Alexandria Falls rendered them navigable at all stages. The channel was deepened from 2½ to 5½ feet at the lower falls and to 6 feet at the upper falls, lengthening the period of navigation about two months.

Persistent snagging operations, repeated from year to year, have kept the river open and enabled steamboats to make regular trips, the river from the Atchafalaya to Fulton, ordinarily being open for boats of 3 ft. draught at stages about a foot above zero of the Shreveport gage.

The maximum draught that can be carried at mean low water is 3 feet to Montgomery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, 320 miles, and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gage stations is as follows: Fulton, Ark., 35 feet; Shreveport, 41 feet; Alexandria, 42 feet; and at Barbee landing 52 feet.

At present steamboats seldom run above Fulton, Ark., but at high stages the river is navigable in fact to Denison, Tex., 800 miles above the Atchafalaya river.

During the fiscal year ending June 30, 1908, snagging operations, etc., for maintenance of the improvement extended over the river between the head of the Atchafalaya river, Louisiana, and Fulton, Ark., and in the autumn of 1907 the upper and lower dikes at Alexandria, La., were repaired and strengthened, and their full effect appears to have been re-established.

The United States snagboat C. W. Howell is operated on Red river continuously except during the short periods when the boat is undergoing minor repairs. During the past year the following work was performed by the Howell: 1,593 snags were pulled and destroyed, 13,554 leaning trees were felled and cut up, 217 stumps were pulled and destroyed, 5 logs were removed from the channel, 632 shore snags were cut, 4 jams were broken up and destroyed, 17 trees were girdled, 779 square yards of willows and brush were cut, and 61 piles were driven in dikes.

3. Plans for further improvement.

In taking up plans for future improvements, the considerations of cost in connection with present and prospective commerce and benefits are serious ones. It will be assumed, however, that it is desirable to make extensive improvements.

Let us first refer to some of the natural characteristics of Red river, and compare them with some of those of the Mississippi, Arkansas, Ouachita, White and Yazoo rivers. The slope of the water surface of a river, taken in connection with the cross section, is important, since it is a function of the velocity of the current. The average slope of Red river from Fulton to Boyce, a short distance above Alexandria, is about 5.7 inches per mile for both high and low water, some reaches

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having a greater and some a less slope. The greatest low-water slope is for a distance of 30 miles above Shreveport, where it averaged about 8.5 inches per mile, whereas from Boyce to the Atchafalaya, the low-water slope averages about 4 inches and the high water slope about 3 inches per miles.

On the Mississippi river, between Cairo and Arkansas City, the slope is greater than 4 inches per mile: between Arkansas City and the mouth of Red river, it is between 3 and 4 inches per mile, and from Red river to the Gulf, less than 1½ inches per mile.

The Arkansas river below Little Rick has a steep slope of between 6 and 7 inches per mile.

The Ouachita river below Franklin Shoals, has a small slope of 1.8 inches per mile, and the White river below Clarendon has a slope of between 1 and 2 inches per mile. The Yazoo has a small but variable slope.

It is observed that where the water slope is steep, the velocity is great, banks are unstable, as on the Red, Arkansas and upper Mississippi, whereas on those rivers such as the Ouachita and the White, where the slope and velocity are small, the banks are stable. It is noted that the unstable banks of Red river are constantly caving; that this process produces great loops in the river, increasing the length, reducing the slope and velocity, and also decreasing the caving, and thus far an improvement is produced. But the caving process continues until the river banks across the necks of the loops join, and the river rushes through, producing a cut off, shortening the river, increasing the slope and velocity, increasing the bank erosion again, and producing sand bars. The ceaseless action of the river improves its regimen, and in so doing brings about the condition which destroys the improvement. Nature thus works in rotation on this river, producing an indefinite repetition of causes and effects. The floods of December, 1902, and March, 1902, for example, caused seven cut-offs, shortened the river 21 miles, increased the caving banks and the number of snags, and destroyed the effect of much work. Many horseshoe lakes along the river are evidence of this process in past time.

It is evident, therefore, that Red river will not improve itself for many years unless some assistance is furnished.

The existing project for improvement contemplates the systematic clearing of the banks to remove the source of drift and snags; continuing snagging operations and the removal of jams and rafts; dredging towheads and shoals; constructing a substantial system of levees to fix the course of the river, either alone or by co-operation with riparian states; the closure of all outlets that deplete the river; the fixing of caving banks, to confine the river to the selected channel, and the prevention of injuries to the regimen by new cut-offs or outlets.

With reference to the first item of this project, viz: the clearing of the banks to remove the source of drift and snags, the progress made in opening up the country has assisted the work of clearing the banks. It is intended of course to clear only that part of the land in the immediate vicinity of the banks. If the banks were perfectly stable, there would be no need of clearing, since there would be no caving and no trees and snags falling into the river.

The next item of the project provides for continuing snagging operations and the removal of drift and jams. Until the banks become stable or free from trees, stumps, etc., it will be necessary to continue this work of removing drift, snags and jams. The great raft no doubt commenced its formation in a small jam. Trees and snags floating down stream were continually added to it until it became an obstruction which surpasses belief. The raft extended over a distance of 90 miles and trees and logs were added to it until it completely blocked the channel and the water was forced to find a new route through lateral bayous. In order that the river may be freely navigated all obstructions of this nature must be promptly removed.

The next item is the dredging of towheads and shoals. There would be great benefit in my opinion derived from dredging in a well-considered manner. While it is true that the dredging of shoals will reduce the water level it reaches further up stream, a dredge would be of great value in assisting to guide the channel when used in connection with other regulating works. The recent rapid development and improvements in hydraulic dredging should not be overlooked in considering the improvements of Red river. On the Mississippi, at the new Southwest pass jetties, dredges are employed to guide the scouring out of the channel and the cost of dredging is about 5 cents per cubic yard—a remarkably low price. No funds are available for the construction of a dredge, and it would be advisable to provide for the construction of at least one hydraulic dredge.

The next item in the existing project is the construction of a substantial system of levees to fix the course of the river, either alone or by co-operation with riparian states. While much good work has been done both by the use of state and national funds in the construction of the present system of levees, this work should be continued in the future until the levees are high enough and thick enough to withstand the highest floods.

The levees are beneficial because they fix the course of the river at high stages, when the water scours out and improves the channel, and because they prevent the overflow of the fertile lands and the destruction of crops and other property. The levee system should be completed to such an extent and maintained in such condition that the property owners may have no anxiety on account of floods. The means to accomplish this result consists in the appropriation of a sufficient amount of money to do the work, and these funds should be provided for carrying on this work. An adequate levee system for Red river would be small in cost compared with the cost of the great system on the Mississippi. The recent flood and destruction of property is evidence of the necessity of increasing the size of the levees.

The next item of the project is the closure of all outlets that deplete the river. A large number of these outlets have been closed. The reason why it is necessary to close them has been discussed above.

The final item of the project consists in fixing the caving banks to confine the river to the selected channel, and the prevention of injuries to regimen by new cut-offs or outlets. This is a very important item of the project, as well as one of the most difficult and expensive. There are several means available to accomplish these results and they are quite necessary to a well regulated condition of the river.

The work necessary consists of revetments to hold the caving banks; dikes to regulate the cross section of the river and to deflect the current at suitable locations; dredging to guide and improve the channel and, perhaps, sills to regulate the slope and cross section. The works required on Red river are not of the magnitude of those on Mississippi river.

The effect of training dikes at Shreveport, Poston Reach and Alexandria are very apparent and the channel responds promptly to these improvement works. I am confident that a continuation of these works and the revetment of caving banks in conjunction with dredging will produce results of great value in the improvement of this river. An extensive plant in the way of material barges, quarter-boats, towboats, etc., is necessary in undertaking this work on a large scale.

The cost of these works themselves will be large, although it will be considerably less than for similar works

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on the Mississippi on account of the smaller size of the Red river works. The revetments will prevent the disastrous cut offs which in no case should be assisted by those interested in the improvement of the river. The revetments and other regulating works will hold the caving banks and protect the levees from being eaten up by the river, thus saving the great expense of constructing new loops.

The cost of the improvement carried on as above outlined is roughly estimated as follows:

Construction of dredge and other plant for regulation works	$250,000
Revetment work, per year	150,000
Snagging, per year	50,000
Levee construction, per year	200,000
Maintenance and operation of plant	50,000

Which amounts to an initial expenditure of $250,000 for plant, which will require 12 to 18 months to build, and an annual appropriation of $450,000 for constructive work. These expenditures would not be excessive by any means, provided a river commerce were developed capable of taking advantage of the carrying capacity of the water way.

It is not thought advisable to commence improvement of Red river at present by locks and dams, because of the obstruction of these works to free navigation, the large amount of sediment and quantities of drift in Red river; the unstable condition of the banks, the lack of foundations for such structures, and the cost.

The bridges across Red river are of interest on account of their connection with navigation.

Bridges generally should be located in a straight reach or very gentle bend of the river, where the channel is fixed and sufficiently large, where the banks are stable, where the approach to the bridge from up and down stream is easy, and where the current is moderate and perpendicular to the axis of the bridge.

The following are references to the bridges now across Red river at and below Fulton, Ark.:

At Fulton, the St. Louis, Iron Mountain & Southern railway bridge is located over the channel on a straight stretch of river. The draw opening is 110 ft. A bar has formed above the pivot pier, but it is not an obstruction to navigation.

The St. Louis & Southwestern railway has a bridge between Fulton and Shreveport. The location is in a bend, but the draw of 133 ft. is over the channel and the current runs well through the opening.

The Vicksburg, Shreveport & Pacific railway bridge at Shreveport, also used as a traffic bridge between Caddo and Bossier parishes, was built in 1884 when there was a large flow from Cross bayou. The draw of 126 ft. was built over the channel, but since that time the current from Cross bayou has greatly decreased and the channel has shifted to the Shreveport side of the river. The present approach from above is very difficult. At low water there is a sand bar under the draw. The reconstruction of this bridge, as well as the construction of a new bridge, is under consideration.

The Shreveport Bridge & Terminal Co.'s bridge, about one mile below Shreveport, is located in nearly a straight reach and has a draw of 131 ft. opening over the channel. The bridge is well located and can be opened quickly with a gasoline engine.

At Grand Ecore the Natchitoches Railway & Construction Co.'s bridge has a draw opening of 160 ft., but the channel is contracted to 139 ft. by the span extending over the bank. The bridge is just below a bend and the location is not good, the current being swift against the banks and shore pier at high water. Dredging to widen the opening, and suitable protection works were ordered but have not been built. The Iron Mountain bridge about one mile above Alexandria has a draw opening of 160 ft. over the dredged channel with good approaches.

The Alexandria & Pineville bridge has a draw of 140 ft. The channel was originally near the west bank but is now on the east side of the draw.

The Shreveport & Red River Valley railroad bridge, with a draw of 133 ft., was begun in 1901. The location is in a straight reach of the river and the opening is over the channel near the east shore.

There is no particular difficulty in passing any of these bridges with boats except, perhaps, the V. S. & P. bridge at Shreveport, although the bridges generally lack protection work, a defect which has been ordered to be remedied.

I have stated that there is a minimum channel depth of 2½ ft. in Red river from its mouth up to Shreveport. During most months of the year there is a great deal more water. The bridges are provided with draw openings, and are required by law to open promptly. The United States maintains a snag boat in constant operation, clearing the river of any obstacles to navigation. As far as the river itself is concerned, conditions are favorable for a large and flourishing commerce. As a matter of fact, boats seldom ascend above Alexandria. Those citizens interested in commerce should give this matter their attention and provide trade upon the river equal to its capacity, which is very large.

The present great flood in Red river has shown that the levees are too weak in many places in the Red river system. On the Mississippi the levees have been built larger and stronger and for the past four months have successfully, with one exception, withstood the great flood which would have otherwise rendered desolate thousands of square miles of the fertile delta country.

The present high water on Red river has been a cause of considerable anxiety on account of its great volume. At its highest stage the river contained 50 times more water than at its lowest flow.

The situation, at a number of points, as near Alexandria, Taylortown, Riverside, etc., has been serious on account of the low levees and their destruction and threatened destruction. If funds were provided and the operations outlined above were carried on extensively and systematically, a great improvement in the control and regulation of floods would be produced.

GREEK TORPEDO BOAT DESTROYER SFENDONI.

The Greek torpedo boat destroyer Sfendoni has just left the Thames for Havre to take the ammunition on board and to adjust compasses, etc., after which she will proceed to Greece. This vessel is the last of four destroyers which have been recently built for the Greek government by Messrs. Yarrow & Co., Ltd., Glasgow (formerly of Poplar, London). The following are the names and speeds obtained: Thyella, 31.79 knots; Nafkratoussa, 32.012 knots; Lonchi, 32.535 knots; Sfendoni, 31.847 knots. The speeds were the result of a three hours' full speed trial at the mouth of the Thames, carrying a load of 60 tons.

One of the largest gasoline yachts ever built was launched recently at the Lawley yards at South Boston, Mass. She was built for Mr. H. C. Fletcher, of Boston, and is 110 ft. over all, 7 ft. 6 in. beam and draws 6 ft. of water. Her two gasoline engines are capable of developing from 100 to 120 H. P. and will give the yacht a speed of 14½ knots. She has storage capacity for gasoline to carry her 1,100 miles at full speed.

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NEW STEAMER FOR CANADIAN PACIFIC.

The twin-screw steamship Princess Charlotte, which is being built for the Canadian Pacific Railway Co., was launched at the Fairfield Ship Building & Engineering Co.'s yards, Govan, near Glasgow, Scotland, June 27, being christened by Mrs. R. Marpole, wife of the Canadian Pacific railway general executive assistant at Vancouver, B. C.

The new vessel, which is intended for coasting service between Vancouver, B. C., and Seattle, Wash., is, generally speaking, on the lines of the Princess Victoria, built at Newcastle-on-Tyne, for the Canadian Pacific railway, in 1903, but she is larger and contains many improvements, especially in internal arrangements. The Princess Victoria, which is in regular service on the Pacific coast, is, according to Lloyd's measurements, 300 ft. long, 40 ft. 5 in. wide, and 15 ft. 4 in. deep, while the new vessel is 342 ft. long, 46½ ft. broad, and 26 ft. deep, to shelter deck. The Princess Charlotte will, therefore, be a very important addition to the Canadian Pacific railway fleet in Pacific waters, and, apart altogether from the increase in size, she will illustrate the great advance that has been made in ship building practice even within so short a period as the past five years, an advance that is not so apparent in general designs as in the many improvements that are continually being made in matters of detail, all going towards the more efficient and more economical working of vessels and the greater comfort of passengers.

The Princess Charlotte is constructed in seven watertight compartments, while the orlop deck is also watertight, thus adding greatly to the safety of the vessel. She has altogether five decks—the orlop, the main, the shelter, the promenade, and the shade decks. She has accommodation for a large number of first class passengers, and a smaller number of second class, all of whom will have cabins containing every possible comfort, and other rooms of the finest and most up-to-date description. The entrance to the passenger accommodation is through watertight doors on the ship's sides on the shelter deck forward. These doors lead to a splendid central hall, paneled in teak, and having a floor laid with terra cotta and white rubber tiles. There is another large central hall aft of the main entrance. This is fitted up with lounge seats, upholstered in crimson plush, and at its after end is the main staircase, which leads to the passenger accommodation and public rooms on the promenade deck. On either side of the forward central hall there are 12 special three-berth rooms, fitted up in a first class manner, with electric radiators, sofa beds, washstands, etc., and also four rooms fitted as bridal chambers. Of these four, two are paneled in light mahogany, and two in satin wood, with dressing tables, washstands, electric heaters, large brass bedsteads, and private bath rooms. On either side of the shelter deck there is accommodation for 176 first class passengers in two and three-berth rooms, fitted in the most modern style, with patent folding lavatories, wash basins, sofa seats, etc. At the after end of the shelter deck there is a central hall similar to that at the forward end, and on the promenade deck there are two spacious halls in a large deck house, with a well in the center of each, giving ample light to the halls below. Over the forward well there is a large ornamental dome-topped skylight, with open sashes for ventilation purposes. On either side there is accommodation for 104 first class passengers in two-berth rooms, furnished in a manner similar to the state rooms on the shelter deck. These rooms, and also a few on the shelter deck aft, have large, rectangular, horizontal, sliding windows, with Venetian blinds, which can be utilized for ventilating the cabins.

Of the public rooms on the vessel the most important is the first class dining saloon. It is entered from the main deck aft, by a stairway from the central hall on the shelter deck. The saloon extends from side to side of the ship, and is capable of seating 133 persons. It is framed in white enameled hardwood, relieved with gold mountings, and is finely lit by large patent pivoted sidelights. The floor is laid with oak parquetry, and at the forward end there are two splendid sideboards with mirror backs.

At the forward end of the promenade deck house already mentioned, there is an observation room, which has specially large plate glass windows, from which passengers will have a splendid view of the vessel's surroundings. The room is tastefully designed, the framing being of mahogany, with a flat white ceiling which, combined with the elaborate electric light fittings, give a very fine effect. In this room there are cosy corners, in which many pleasant hours may be spent by passengers; and also writing tables, large comfortable basket chairs, stools, and circular radiators with marble tops. The room is carpeted and upholstered in green, with amber-colored and gold-fringed curtains.

The smoking room, at the after end of the vessel, is framed in light fumed oak, with carved panels, and large plate glass windows. The windows, with the circle-topped skylight overhead, provide plenty of light and ventilation. The interior of the room is broken up into several bays, with tables and chairs upholstered in brown hide leather. The floor is laid with rubber tiles, and at the forward end there will, when the vessel is completed, be a well-equipped bar. The ladies' tea room, at the after end of the shelter deck, is neatly finished in light oak, with inlay panels and blue and cream furnishings.

At the extreme forward end of the vessel there is a large smoking and sitting room, and also bar and dining saloon, for second class passengers, to the number of 48, with a stairway leading to lavatory and sleeping accommodation on the main and orlop decks, respectively. At the forward side of the main entrance to the passenger accommodation there are purser's office, barber's shop and baggage room, and forward of the saloon there are galley, pantry, and store rooms, with all the latest facilities, such as electric dish washers, lifts, etc., for catering for a large number of passengers. Far forward there are mail sorting room, petty officers' rooms, second class lavatories, and the windlass compartment. On the shade deck, which forms a spacious promenade, to which access is obtained by ladderways at the fore and after ends, there is a large deck house providing accommodation for captain and officers. The pilot house, from which the vessel will be navigated, is at the forward end of the shade deck, and above it there is the flying bridge, carrying steering standards and electric light projector, and from which also the vessel can be navigated. The orlop deck forward and aft is utilized for crews' quarters and officers' and engineers' mess rooms. At the stern of the vessel is the steering compartment, fitted with patent gear, controlled from the pilot house, the flying bridge, or the shelter deck aft.

On the main deck, amidships and forward, space is provided for carry-

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ing cattle or other cargo. To this space access is obtained by large watertight doors in the ship's sides. The accommodation aft is ventilated by electric fans as well as by ordinary means. The vessel, which is fore and aft rigged, has three funnels. These give her a very fast and handsome appearance. She will carry 10 steel life boats on the shade deck.

The propelling machinery consists of two sets of inverted, direct-acting, triple-expansion engines, each set having four cylinders and four cranks. The engines are balanced, and they have been specially designed so as to reduce the vibration to a minimum when running at a high speed. They are of the open fronted type, the four cylinders of each set being supported—on the side nearest the center of the ship by four cast iron columns to which the crosshead guides are fixed, and on the outer side by six polished columns of forged steel. The main condensers are separate from the engines. All the pumps, including the air pumps, are independent and steam driven. The steam generating plant consists of six single-ended multi-tubular boilers of the cylindrical type, designed for a working pressure of 180 lbs. per sq. in., and fitted with forced draught and open stoke holds.

MOSS & CO.'S SHIPPING REPORT.

H. E. Moss & Co., of Liverpool, London and Newcastle, in their usual semi-annual report on the shipping and ship building industries, write as follows:

"The anticipations as to the prospects of steam shipping and ship building predicted in our last semi-annual circular have been more than fulfilled, but as unsatisfactory as they were then, they are far worse today, in fact during the half century we have been accustomed to write these lines, the times we are now passing through are the worst on record. In former years these cycles of depression in shipping were not so universally felt, for in some parts of the world payable employment was obtainable. All this has arisen, firstly, through the recent financial crisis in America, which adversely affected commerce in all directions, and set nearly everything on the downward grade; then we have had the record building of tonnage during recent years, together with ill-advised legislation as to increased freeboard; then lastly, the disappointing harvests abroad, which, coming together, have contributed to bring about the present state of affairs. In our opinion so many combinations are not likely to occur simultaneously again for many years to come, at least in steam shipping. What interests us presently is as to the future. Shipping, we all know, is the first to feel the effect of depression in trade, but the last to benefit by any improvement. The present crisis has been so acute we should think the reaction will be all the sooner. If trade is bad in the United States it reflects on this country in particular, and vice versa. It is said there are already indications of improvement in America, but this will have to extend to German and other continental centers before the lessened output of new tonnage will again equalize the everlasting problem of supply and demand. The reports of the coming harvests in the United States, in Canada, and in India, are most encouraging, and we should think will help to relieve the market in the autumn, and by next year we should expect to see the beginning of some improvement in shipping.

"The amount of mercantile tonnage under construction on June 30, last, was about 800,000 tons, being fully 450,000 tons less than a year ago, and is the lowest total recorded since 1896. We should estimate the total amount of new tonnage to be turned out in the United Kingdom this year at about 1,200,000 tons, which, compared with about 2,000,000 tons in 1907, and about 1,600,000 tons in 1906, should ameliorate the situation.

"The depreciation in the value of steam shipping has been appalling; new cargo steamers of about 7,000 tons dead weight capacity presently building, and which a few years ago easily realized £48,000, have recently been sold at £35,000, or about £5 per ton deadweight, and at this price steamers of similar tonnage with moderate specifications can be built today, and other sizes in proportion.

"Second-hand steamers have depreciated to a greater extent, and some steamers of about 6 000 to 7,000 tons have been sold at about half their cost four or five years ago. Very little business has been done during the last six months, for though the supply of tonnage is great, buyers are scarce, and transactions are difficult to carry through. In spite of all this forced sales have been but few.

"Ship builders are feeling the pinch most acutely, many yards are empty, and but few are partially occupied, mostly with liners and special types of steamers. The competition for new orders is exceedingly keen, and is likely to be more so as the work in hand is completed. Whether the price of steel and coal will fall further is an open question. We should think it will likely do so, but ships are very cheap to build now, and should attract buyers. That the present is a favorable opportunity for men with capital to buy or build with late delivery and wait developments goes without saying.

"Why the employes in the ship building trade recently struck work, and the engineers on the northeast coast still remain out on strike under existing circumstances, is beyond comprehension. They have misjudged the time. It should have occurred two or three years ago.

"The new turbine steamers of the Cunard Co., the Lusitania and Mauretania, have proved an unqualified success, and demonstrated, without doubt, that the turbine for fast passenger steamers has come to stay, and is now being generally adopted in our coasting trades where speed is necessary, for which several steamers are presently building."

ASSUAN'S FINE REMITTED.

Collector Stratton, of the port of San Francisco, has been advised by the treasury department to remit the fine of $25,000 assessed against the master and agent of the Kosmos liner Assuan for coming into San Francisco minus consular bills of health from five foreign ports of call. The explanation of this neglect was contained in a letter from Capt. R. Paessler, master of the Assuan, which was forwarded to Washington and on which the officials acted. He said that when he cleared from Hamburg his destination was Central American ports. Hence he did not get bills of health from consuls of this country at Genoa, Cadiz, Teneriffe, Acajutla and San Jose de Guatemala. When he reached La Libertad, however, he found instructions from the owners to proceed to San Francisco and, as the United States has no consular agent there, he was unable to get a bill of health.

The secretary's letter closes by instructing Stratton to inform the offenders that this action on the part of the government is not to be taken as a precedent.

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PACIFIC TRADE ABANDONED.

The prediction made some time since that American oversea shipping is to expire on the Pacific ocean has practically come true. Notice has been given by the Trans-Continental railways, which control the Pacific steamship lines, that export trade on the Pacific will be abandoned after Nov. 1. This means that China, Japan, New Zealand and Australia are closed chapters in so far as the American merchant marine is concerned.

In a recent interview, James J. Hill said that he had reached the conclusion that the United States was not a maritime nation and that he had decided to get out of the business. When the steamship Dakota was wrecked some time ago he announced that he would not replace her, but a supplemental announcement means the surrender of the entire oversea trade. It is certainly a shameful thing that the American government through its short-sighted policies has brought such a condition about.

"The proposed action of the railroads is the beginning of the end of the American merchant marine on the Pacific," said Congressman W. E. Humphrey who fought vigorously in congress at the last session for a subsidy for Pacific merchantmen. "There is no doubt that American vessels are going to disappear from the Pacific very soon," continued the congressman. "I made the statement on the floor of the house last winter that we would not have a ship left on the Pacific in a year and a half. This prediction is evidently coming true. If it is no longer profitable to operate ships in connection with the railroads, certainly it means the end of American ships on the Pacific, for only a few are left now. The two vessels of the Boston Steamship Co. have been seeking a purchaser for two years. If the railroads cannot run ships, then they are doomed, for no American ships not connected with railroads can possibly compete with foreign vessels, on account of the subsidies paid foreign bottoms. The Japanese line operating out of Puget Sound has been awarded $326,000 in gold this year. The line from San Francisco received approximately $600,000. When we consider the subsidies paid, and the difference in operating the ships, and the capital invested, the whole story is told.

"This action of the railroads will mean a tremendous loss to the whole Pacific coast. It will mean that the trade we hold will be carried in foreign bottoms, and it also means that most of that rade will be done via the Suez canal, direct to the Atlantic ocean.

"There is but one remedy, in my judgment, that is for our country to pay subsidies just as every other shipping country in the world does, and just as we are now doing on the Atlantic.

"This loss of the Oriental trade, and the impossibility of the navy making its globe encircling trip, except with the assistance of foreign ships, will, I believe, bring the matter of the upbuilding of our merchant marine so forcibly before the American people that legislation will not be longer delayed."

The *San Francisco Commercial News* is out with an editorial to the effect that the recent visit of the battleship fleet was a positive detriment to the Pacific ship owner. It says:

"That the people of the state of California were glad that the fleet came is answered by its cordial reception by all classes of society.

"Certain classes in the community were benefited financially, i. e., places of amusement and the water front merchants.

"There is a mistaken idea abroad that all have benefited. This is not the case.

"In fact one class of our citizens has been injured to a very considerable extent—that is, the ship owner.

"The very business that our great fleet can be called on to protect in the Pacific ocean has, by unwise laws and worse regulations, dwindled down to six merchant passenger steamers in the Oriental trade.

"Think of 16 battleships to protect six merchant steamers. It can't be possible that the people of this great nation know this or they would rise in their might and demand laws that would restore to the American flag a merchant marine worthy of the name; one that would enable our merchants to hold their own in the foreign trade, and in time of war would be of invaluable service to our fleet.

"This cruise of the fleet has demonstrated beyond any fear of contradiction that without the assistance of foreign colliers it was impossible to move the fleet from one side of the continent to the other.

"This being an actual fact patent to all, it is very evident that in the event of war our fleet would be unable to move to any distant point, as the neutrality laws between nations would prevent the chartering of foreign colliers to transport coal for our battleships and cruisers; in fact the fleet could not reach the enemy.

"The question is asked how was American shipping on this coast damaged by the coming of the fleet? It was this way:

"The coal to supply the fleet was all brought to the west coast of America from the Atlantic coast by 41 foreign tramp steamers.

"A landsman would say, 'How could that affect ship owners?' My answer is by bringing 41 steamers of 176,000 tons gross register, carrying about 240,000 tons of coal. These steamers, when discharged, had to get away from the coast, and they flooded and overburdened the market, competing sharply for any and all business offering for the foreign trade. Seven of them left in ballast. Others took cargoes to the Orient at $1 per ton, and some got as high as $2, which is less than half

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a living rate. Some took cargoes to Australia at rates never heard of before.

"The same can be said of trade to China and Japan, so that the American sailing vessels engaged in the foreign trade had all to lay up until the tramp steamers could get off the coast. They are not all gone yet, so American vessels are still laid up; a glance at our harbor will demonstrate this. Oakland creek and the harbors of Puget Sound are all crowded with idle American ships.

"The regular line steamers, on which we depend so much for trade and commerce, of which only six vessels are American, have also suffered much and it is quite common to read of big steamers sailing with 2,000 to 3,000 tons of cargo, whereas if conditions were normal and the fleet had not come here these steamers would be going out with 10,000 to 20,000 tons of cargo each.

"What we want is to educate the people to the necessity of helping and not retarding the growth of our foreign shipping."

PIG IRON SITUATION.

Inquiries for freight cars and specifications on contracts in nearly all lines have brought encouragement to the iron market, but actual new business has been light. Inquiries for about 25,000 tons of pig iron are pending in the eastern territory, and about the same quantity in the central west. The pig iron market in the south is much firmer, and pig stocks throughout the country are low. The demand for wire products continues active, but tin plate production has dropped off in the last week. Steel billet specifications on contracts in the Pittsburg district are now the best of the year. Structural material is active. A number of railroads have placed orders for steel for grade crossing abolition and bridge work.

NAVIGATING THE WEST NEEBISH.

The new West Neebish channel was opened to traffic on Sunday morning last, the steamer George F. Baker of the Pittsburg Steamship Co.'s fleet being piloted through by W. W. Smith, chief engineer of the company. President Wm. Livingstone of the Lake Carriers' Association was aboard as were also Secretary Marr of the association and Supt. L. C. Sabin of the Sault Ste. Marie canal. The Canadian steamer Conestoga was the second boat through, following the Baker closely.

The opening of this channel practically finishes the double tracking of channels between Buffalo and Duluth. The West Neebish provides a passage exclusively for down-bound vessels and should minimize the danger of collision in narrow passages. It will be open for night traffic after Sept. 1. This work has been under way since the spring of 1903, and it was structurally completed last fall. Work will be begun at once upon deepening the Middle Neebish.

Orders for the navigation of the West Neebish for the time being as promulgated by Col. Townsend, government engineeer, are:

That until Sept. 1 masters can take their choice as to whether they come down the new channel or down the Middle Neebish. Col. Townsend considers that masters should be given the time intervening between now and Sept. 1 to familiarize themselves with the channel. On and after Sept. 1 all down-bound boats must use the West Neebish channel.

The channel will not be lighted until Sept. 1 and no boats will be allowed to run the channel after nightfall until that time.

LAKE FREIGHT SITUATION.

The freight situation continues in much the same shape as last week, ore sales being scarce and chartering light. New men are being put to work on the docks at Superior and Marquette, but a full quota are not yet employed. Naturally work is slow at these docks and the delay occasioned might be sensibly felt were not conditions so abnormal. Wild vessels get slim picking as shippers have all that they can do to take care of contract tonnage. Improvement in September is more hoped for than expected. The year 1908 will be remembered as one of the dullest in lake history.

CONDITION OF WRECKS OFF CALUMET HARBOR.

The United States lake survey steamer Search, which is sweeping the south end of Lake Michigan, reports a clear depth of only 22 ft. at the present high stage of Lake Michigan, over the wreck of the car ferry Barge No. 2, sunk in June, 1907, and partly removed by the government in July and August, 1907. It lies 3⅛ miles N. 73° 45′ E. (azimuth 73° 45′) from Calumet Harbor lighthouse, in 45 ft. of water.

This wreck and that of the schooner David Dows, lying easterly about 3½ miles, as recently reported by the lake survey, have been temporarily marked with spar buoys flying white flags with red centers.

The tug Tom Dowling, built in Cleveland in 1873, caught fire at Ashland this week and sank.

RELIC OF PIONEER STEAMBOAT.

What may be a valuable and interesting relic was dug up at the Soo the other day. It narrowly escaped more years of obscurity. The Vulcan shovel, in charge of Dave LaPrairie, dug up near the surface a short distance west of the swing bridge an old ship propeller, which is constructed similarly to the old Independence wheel, now located near the south wall of the Poe lock. The relic was dumped on the car and was about to be carried away when someone began to examine it. Then it was dumped off the car and still lays there. It has about the same diameter as the Independence wheel and has five flanges bound around by a wide piece of iron. The suggestion which received most credence is that it is the propeller of the old Manhattan, which was portaged across in 1850. She plied on Lake Superior for a number of years, and in 1854 the old wheel, which this is supposed by some to be, was discarded for a wheel similar to that now used. Capt. John Spalding was sailing the Manhattan at the time, he letting her go in 1856. What disposal of the wheel will be made is not known. Supt. Mackie, of the Great Lakes Dredge & Dock Co., stated that he would gladly turn it over to the government if it manifests any desire for it.

OBITUARY.

Capt. J. F. Ahlstrom died at his home near Fairport on Tuesday, Aug. 11, at the age of 57 years. He was born in Finland and before coming to this country had a large experience in deep sea ships. His lake experience was equally wide and his license as a master of vessels entitled him to take a steamer anywhere in navigable waters throughout the globe. His early experience on the lakes was in sailing ships, but he later commanded many of the modern steamers. In 1901 he left the lakes to take the steamer Meteor to Seattle, but immediately returned to enter the employ of the Hawgoods. His last steamer was the J. M. Jenks. Two years ago he retired to his farm near Fairport.

The new patrol boat Grover Cleveland, building for the police department of Buffalo, was launched at Buffalo on Monday last. The new boat is 70 ft. long, 15½ ft. beam and 6 ft. deep.

The steamer Mariska is in dry dock at Cleveland. She struck a log on Lake Superior and lost her shoe.

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DUTY ON VESSEL REPAIRS.

Following is the full text of the amendment to the customs act, revised statutes of Canada, relating to duty on vessel repairs, passed by the Dominion parliament at its recent session:

"Sec. 70. The equipments or any part thereof, including boats purchased or supplied in a foreign country for, or the expense of repairs made in a foreign country upon, a vessel intended to be employed, or which is thereafter employed, in the coasting trade of Canada, shall, on the arrival of such vessel in any part of Canada, if arriving within one year after such repairs have been made or equipments purchased or supplied, be liable to entry and the payment of duty on the cost thereof in such foreign country at the following rates, viz.: (a) On the expenses of repairs, 25 per cent ad valorem; (b) on equipments, including boats, the same rate of duty as if the articles were imported into Canada in the ordinary course.

"2. If the owner or master of such vessed shall wilfully and knowingly neglect or fail to report, make entry and pay duties as herein required. such vessel, with her tackle, apparel and furniture, shall be seized and forfeited.

"3. If the owner or master of such vessel shall, however, furnish good and sufficient evidence that such vessel, while in the regular course of her voyage, was compelled by stress of weather or casualty to put into such foreign port or to make such repairs, to secure the safety of the vessel to enable her to reach her port of destination, or that it would be impracticable to make the repairs in Canada for the want of a dock of sufficient capacity to receive the vessel, then it shall be competent for the minister of customs to authorize the refund of the duties on such repairs, and such vessel shall not be liable to forfeiture under the next preceding section. Provided that repairs in the course of being made to a vessel in a foreign country at the time when this act comes into force or made prior to such time shall not be dutiable under the said act."

A deputation of some 15 to 20 members of the Dominion Marine Association, representing the principal companies in its membership, waited on the ministers of customs and marine on July 2, and protested strongly against the proposal to impose a duty of 25 per cent on all vessel repairs and equipments made in the United States. The deputation's protest finally resolved itself into a very emphatic one, declaring it to be unfair to impose a duty even in cases where a Canadian dock might not be available for repairs. The minister of customs was equally emphatic in saying that if a vessel owner did not care to tie up his vessel and wait until the Collingwood dry dock was empty, he could take the alternative, that is, go to the United States and pay the duty when his vessel returned. The minister of customs expressed no intention to have any mercy upon vessel owners, and insisted on the propriety of his resolution, in the face of the apparent fact that it would establish a monopoly at Collingwood, where whatever prices the yard thought proper might be charged, so long as they were less than United States prices, plus the duty. H. H. Gildersleeve, manager of the Northern Navigation Co., who lives at Collingwood, made a very clear and forcible address, in which he pointed out that the present action, although possibly designed to foster Canadian industries, would be of little benefit for the present, as the Collingwood dock was getting plenty of work and the result of the minister's resolution would simply be to force Canadian vessels to go to the United States for repairs and pay a duty. Of course the government's revenues would be swelled by this tax levied on vessels. Incidentally the Collingwood dry dock would become a monopoly as well. Mr. Gildersleeve pointed out very clearly that a duty on repairs is not sufficient to encourage the ship building industry in Canada, as ship building is the key to the success of a ship yard, and occasional repair work would not keep a yard going. When the minister of customs' resolution came up in the commons July 4, he stated that the only conditions under which he would permit a refund of duty would be where a vessel was compelled by stress of weather or casualty to put into a foreign port to make repairs in order to secure her safety, or enable her to reach her port of destination, or where there is no dock in Canada of sufficient capacity to receive the vessel, or where the repairs are pending at the time the act comes into force.

LAKE SHIPYARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

Section 5, the hopper system and latest idea of vessel construction on the great lakes.

The numbers in this case denote almost the order of laying out and erecting the material, the keel plating No. 1 is the first piece to be erected although the decks may be punched and ready for erecting in place, such being the advantage of building by the mold system.

The keel liners, keel angles, center keelson plate and angles come next, and so on.

Midship section:

1. A keel plating.
2. Keel liner.
3. Keel angles.
4. Center keelson plating.
5. Center keelson top angles.
6. B strake shell plating.
7. C strake shell plating.
8. D strake shell plating.
9. E strake shell plating.
10. Bilge strake shell plating.
11. H strake shell plating.
12. J strake shell plating.
13. K strake shell plating.
14. L strake shell plating.
15. Seam strap shell plating.
16. Sheer strake shell plating.
17. Center keelson bracket plate.

17a. Center keelson bracket plate angle.

18. Channel floor.
19. Top side frame.
20. Bilge bracket.
21. Continuous girder stiffener.
22. Continuous girder stiffener bracket.
23. Continuous girder plate.
24. Intercostals to bottom plating.
25. Continuous girder bottom angles.
26. Tank top stiffeners.
27. Continuous girder intercostal top angles.
28. Continuous top girder angle.
29. Tank top plating A strake.
30. Tank top plating B strake.
31. Tank top plating C strake.
32. Tank top plating D strake.
33. Tank side plating E strake.
34. Tank side plating F strake.
35. Tank side plating G.
36. Tank top plating seam strap.
37. Tank side stiffeners.
38. Tank side stiffeners bracket plates.
39. Brace brackets.
40. Brace channels.
41. Tank side top bracket plates.
42. Tank side top plating.

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43. Tank side top plating angle.
44. Tank side top intercostals.
45. Side stringers.
46. Side stringers intercostals.
47. Bilge stringers continuous angles.
48. Spar deck beam bracket.
49. Spar deck beam.
50 Spar deck intercostals.
51. Spar deck hatch opening fore and afters.
52. Spar deck continuous channel girders.
53. Spar deck outer stringer plating.
54. Spar deck stringer angle.
55. Spar deck inner stringer plating.

The erecting of this vessel depends a good deal upon the arrangement of the tank side top.

If the top No. 42 is in one piece the topside frame No. 19 is cut above the plate and bracketed to same.

The framing on side between webs is all riveted together and put up in place complete ready for the plating as shown in previous articles.

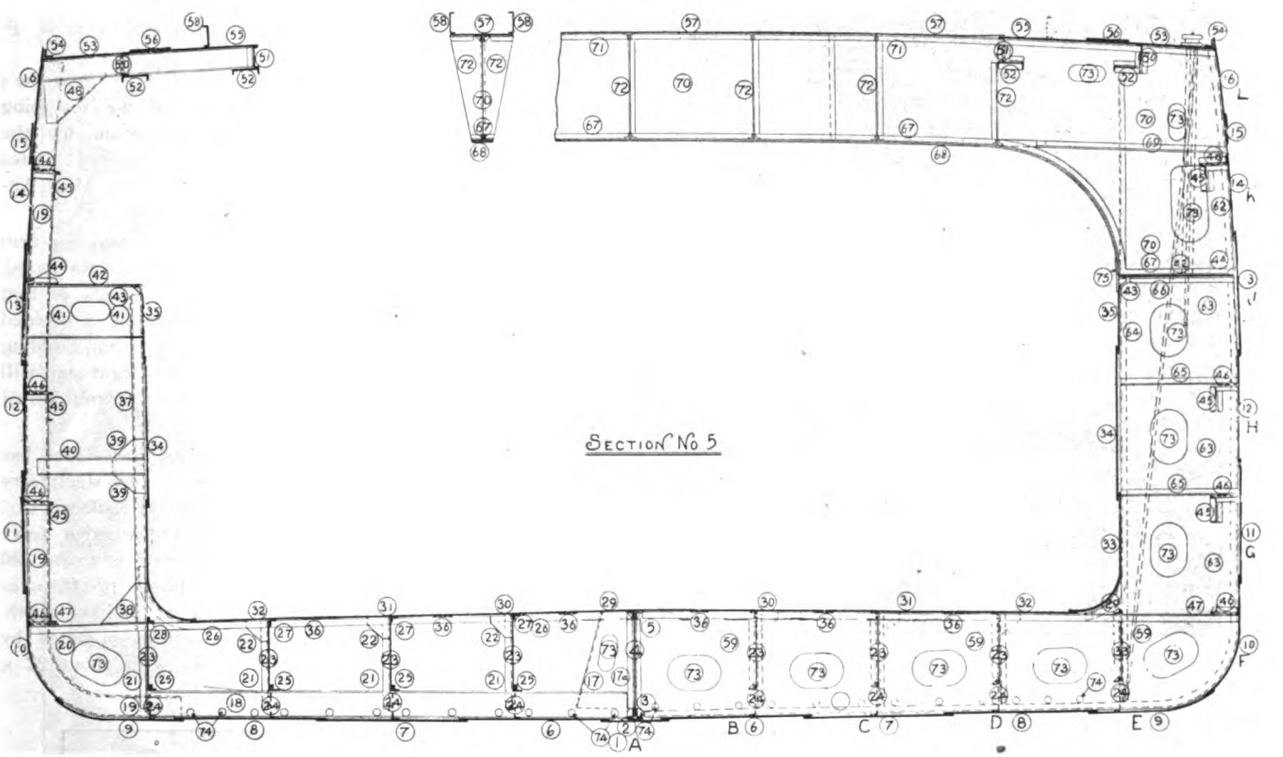
In the bottom after the keel plate, keel plate liners, keel angles, center keelson plate and center keelson top angles are riveted and the center keelson calked the bottom plating strakes 6, 7, 8, 9 and 10 are erected and the frame angle 60 is in one piece from the keel to the under side of the side tank top.

The deep floor and the web plate and frame as well as the stiffeners and face angles are all riveted and erected in one piece again dispensing with the small pieces on the vessel.

The top part of the frame, No. 62, is riveted to the arch plate as well as the brackets 72 and all the other completing the arch beam.

There are several advantages in this style of construction over the others but the two most noticeable are the ease in unloading and the additional ballast accommodation.

Section No. 4, the arch system, is all that may be desired in a system of clear hold with no obstacles in the way. The clam shells used in unloading these vessels play havoc with the tank tops and very few tank tops are watertight, in a way disallowing the full advantage of the side tanks in the hopper arrangements.



56. Spar deck stringer plating seam strap.
57. Spar deck plating.
58. Spar deck hatch coaming.
59. Deep floor plate.
60. Deep floor plate and web frame.
61. Deep floor plate top angle.
62. Arch Frame.
63. Web plate.
64. Web plate face angle.
65. Web plate stiffeners.
66. Web plate top angle.
67. Arch beam face angles.
68. Arch beam face plate.
69. Arch beam plate stiffener.
70. Arch beam plate.
71. Arch beam plate deck angles.
72. Arch beam plate brackets.
73. Lightening holes.
74. Limber holes.
75. Arch beam gussets.

or are being erected at the same time as the keel and center keelson work. The center keelson bracket angles 17a are riveted to the center keelson plate thus completing the center keelson.

The center keelson bracket 17, channel floor 18, girder stiffeners and brackets 21 and 22 and intercostal clips are riveted together and erected in one piece.

The bottom plating being in place fairs up the framing in way of same.

This will show that all the small pieces are fitted and riveted on the ground before erecting dispensing with the nuisance of fitting same on the ship during the erecting process.

The deep floor 59 is in one piece from the center keelson to the bilge

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The Skinner Ship Building Co., Baltimore, Md., has the old side-wheel revenue cutter Fessenden, recently purchased by George L. Craig, of Toledo, O., at its yard preparing her for her trip to the great lakes. She will be taken in tow by the cutter Dallas, also recently purchased by Mr. Craig.

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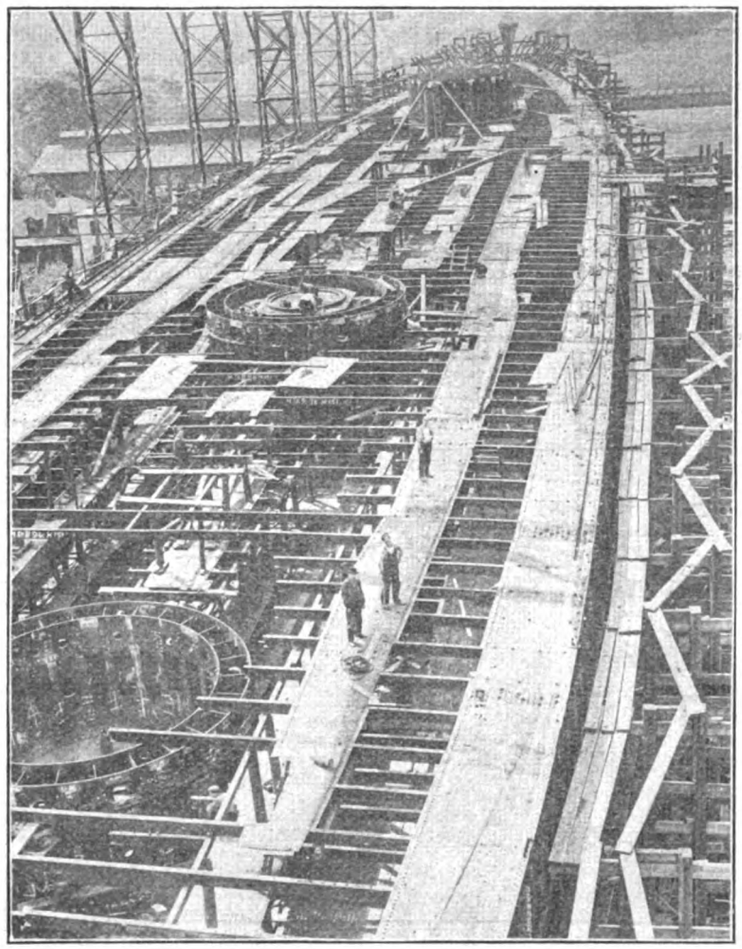
PROGRESS OF BATTLESHIP NORTH DAKOTA.

The accompanying photographs show the battleship North Dakota on Aug. 1, at which time the vessel was 45.9 per cent complete—a gain of 5.2 per cent for the month. The present expectation of the Fore River Ship Building Co. is to launch her on Nov. 9.



BATTLESHIP NORTH DAKOTA, ON AUG. 1.

SHIP YARD NOTES.

The United Engineering Works, Oakland, Cal., has sold the 70-ft. steel oil-burning launch which it has under construction to the department of commerce and labor for use in the immigration service at San Francisco. The price was $22,000. The boat has a beam of 14 ft. and a molded depth of 6½ ft., and she will accommodate 100 passengers, having cabin capacity for 40.

Crawford & Reid, of Tacoma, Wash., have begun the construction of a steam halibut fishing vessel for Capt. Andrew Weiding and associates, of Seattle, Wash. The craft is to be one of the best of her class and will cost when complete about $45,000. Her dimensions will be: Length, 120 ft.; beam, 21.6 ft.; molded depth, 13 ft. She is to be fitted with fore and aft compound engines with cylinders of 11 and 25 in. respectively, and a stroke of 24 in. It is expected that the vessel will be ready for launching by the middle of October when she will go to Seattle to be fitted out, it being planned to have her in commission by December.

Ira S. Bushey, South Brooklyn, N. Y., has been awarded contract by the city of New York for the construction of 15 scows for municipal use.

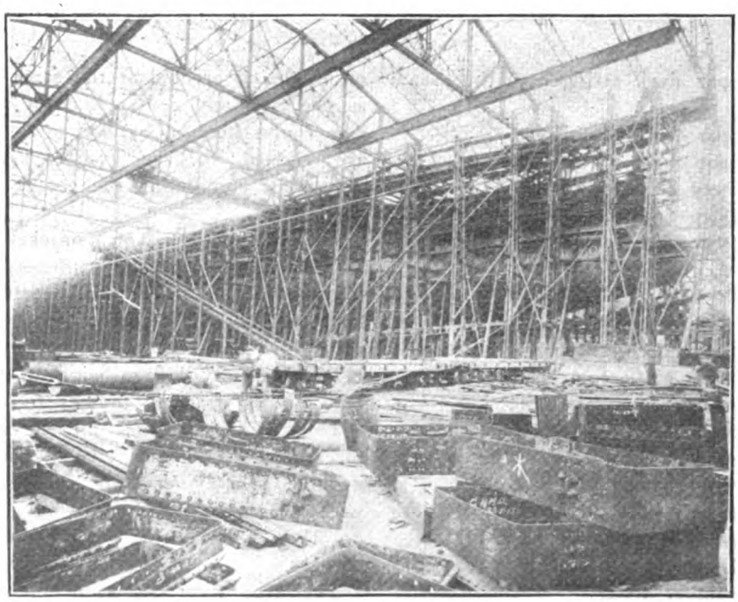
The Morse Dry Docks, Brooklyn, N. Y., are effecting repairs to the American-Hawaiian line steamer Missouri. She is also having her furnaces altered for oil fuel.

Capt. Smedburg, of Muckilteo, Wash., has taken a contract to build a tug for the Seattle Sand & Gravel Co., of Seattle, Wash., which is to be 42 ft. long, 10 ft. beam, and will be fitted with a 20 H. P. Union engine.

The Maryland Steel Co., Sparrow's Point, Md., has launched the sea-going suction type dredge Galveston for the Engineer Corps of the United States army. She was christened by Miss Annie P. Craighill, of Baltimore.

The creditors of the ship building firm of John Dickie & Son, at Raymond, Wash., have attached the assets of that company, and unless there is a decided revival of business in the ship building line it is probable that this legal step will remove any possibility of a resumption of business at this yard.

The Bath Iron Works, Bath, Me., has a contract for building a new steel ferry boat for the Maine Central Railroad Co., to take the place of the wooden ferry Hercules. The new vessel is to be 240 ft. in length, 47 ft. beam, 67 ft. over guards, and 17 ft. 6 in. molded depth. Her paddle wheels will be operated by two horizontal engines with about 22 x



BATTLESHIP NORTH DAKOTA, ON AUG. 1.

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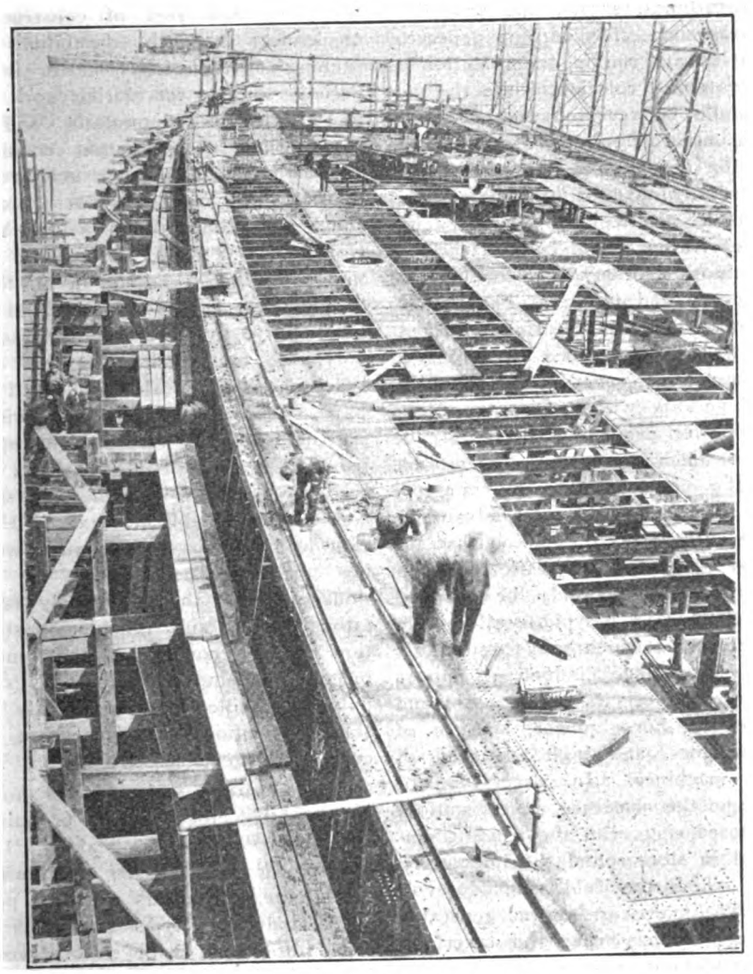
48 cylinders and two Scotch boilers 13 ft. in diameter. She will have three tracks, accommodating three cars each. The entire construction is to be of steel with the exception of the two pilot houses.

Andy Linton, a boat builder at Vancouver, B. C., has during his life built 5,000 boats. For the last 25 years he has built one boat per day. They are of the type used on inland waters by gold prospectors and for fishing. His own sawmill gets out the timbers and the boats are fashioned by a small force of workmen.

The Durlee Dry Dock Co., of Port Richmond, Staten Island, N. Y., has changed its name to the Staten Island Ship Building Co. There has been no change of ownership and officers remain the same as previously.

John F. Walsh, Jr., who recently, in company with several associates, purchased and put in working order the dry docks formerly operated by Frank Gokey, at Weehawken, N. J., now has the Ward line steamers Colonia and Nautilus hauled out together on the big dock, where they are being rebuilt. The docks are advantageously located on the North river and there is every prospect that their rehabilitation will prove a successful venture.

The William Cramp & Son Ship & Engine Building Co., Philadelphia, Pa., is reported to have a contract for furnishing new boilers to the Morgan Line steamship El Sud and thereafter to such other steamships of the line of the same class as shall be in need of them, using in each succeeding vessel such portions of the old boilers taken from the vessel preceding it at the works as shall be in sound condition.



BATTLESHIP NORTH DAKOTA, ON AUG. 1.

The twin-screw suction dredge Galveston was launched from the yard of the Maryland Steel Co., Sparrow's Point, Md., for the United States government recently and was christened by Miss Annie P. Craighill. The dredge is 304 ft. over all, 290 ft. between perpendiculars, 51 ft. beam and 27 ft. deep. Her propelling machinery consists of two compound engines, with cylinders 22 and 44 in. diameters by 30 in. stroke. The dredging machinery is made up of two large 20-in. suction pumps driven by a compound engine with 17 and 36-in. cylinders by 18-in. stroke.

Joseph McGill, ship builder at Shelburne, Nova Scotia, launched the schooner Albert J. Lutz Aug. 6. The Lutz was built for a syndicate of fishermen from designs by McManus, of Boston, and is the following dimensions: Length, 102 ft. 6 in.; beam, 23 ft.; depth of hold, 10 ft. 4 in.

The Harlan & Hollingsworth Corp., Wilmington, Del., is repairing the Merchants' & Miners' line steamer Parthian which recently had her superstructure badly damaged by fire at Philadelphia.

The Green Ship Yard, Chelsea, Mass., has two knockabout fishing schooners of about 80 tons each ready for launching.

The City Island Ship Building Co., City Island, N. Y., has filed a petition in bankruptcy, the schedule showing liabilities of $53,498, of which $30,000 is secured by mortgages. The nominal assets are shown to be $63,900, consisting of real estate valued at $40,100, mortgaged for $30,000, and about $25,000 worth of improvements, machinery, accounts, cash, notes, etc.

The Staten Island Ship Building Co., Port Richmond, S. I., N. Y., which was formerly known as the Burlee Dry Dock Co., has sold the new steel tug which is now on the stocks at its yard to the Scully Towing Co., of New York. She will be delivered to the purchaser next December. The same company also has a fine steel tug in stock ready for service. A recent addition to the equipment at this plant is a large new dry dock.

The work of constructing the new fire boat for the city of Seattle, Wash., bids for which were recently opened, has been divided up as follows: Hull by the Puget Sound Ship Building Co., of Seattle, Wash.; machinery by the Fulton Machine Works; four Mosher boilers, by the Pacific Engineering Co.; pumps by A. G. Long, Portland, Ore.; generators by the General Electric Co. A small portion of the machinery is to be purchased direct from the manufacturers while the city shops will build the 2-in. monitors, of which there are to be six on the boat.

Cobb, Butler & Co., Rockland, Me., are planning to have a double launching in September. One of the vessels will be the four-masted schooner Lewiston and the other the three-masted schooner Frank Brainard.

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STEAM-ELECTRIC MARINE PROPULSION.

A paper, by Mr. William P. Durtnall, entitled, "The Generation and Electrical Transmission of Power for Marine Propulsion and Speed Regulation," was read before the Institute of Marine Engineers at a special meeting on Saturday last in the Congress Hall, Franco-British Exhibition, Mr. Alexander Boyle, vice president of the Institute, in the chair. Leading up through the stages of development in reciprocating engines to the adoption of steam turbines in ship propulsion, the author pointed out the few but important disadvantages involved in the direct-coupled turbine. It was necessarily designed to run at very low speed to permit the use of a propeller of high propulsive efficiency, and consequently its diameter and weight were increased to a very great extent. The blade clearance was also greater to allow for expansion and contraction, involving higher consumption and leakage of steam. There was also the difficulty of reversing, and the increased consumption per horse-power when working below full load and speed. Tests on the Lusitania had shown an increase in consumption from 14.46 lb. to 26.53 lb. of steam per shaft horse-power per hour when speed was reduced from 25.4 to 15.77 knots. The ability to maneuver was of little importance with ships making long runs, but very important in short-voyage vessels and ships of war, in which frequent starting and stopping and maneuvering in and out of harbor or in squadrons was necessary. To meet these requirements, astern turbines, of about one-third the total ahead power, and coupled to separate propeller shafts, were carried. The dead weight was therefore only partially utilized. Full power speed at reverse was only possible with a complete duplication of turbines, but the safety thereby secured was possibly of more importance in short-trip vessels than the increased weight involved. In order, therefore, to secure the complete success of the steam turbine for ship propulsion, means would have to be devised to allow the turbine to run at high speed and the propellers at comparatively low speed, so securing economy in both cases, and also to provide reverse motion for all shafts. After alluding to mechanical, hydraulic, and compressed air devices which had been tried and found inefficient, the method of electrical power transmission was stated to be that in which the greatest possibilities lay. This system supplied the very elements required to take advantage of high-speed turbines, saving weight and securing high economy in steam, by utilizing these to drive electric power generators, the current so generated being used to drive low-speed motors coupled to moderate speed large-bladed propellers of high efficiency. This method of transmission would do away with the necessity of extra turbines, shafts, and propellers for reversing. The turbine generator would always run in one direction as regards speed rotation, while the motor could be reversed and efficiently run in either direction. Moreover, the direction of rotation and speed could be instantly changed to meet all conditions in practice, and this very important feature could be utilized with the utmost economy even at the lowest speeds and powers. The electric motor, as well as the turbine and generator, had also the capability of standing very severe overloads for short periods without damage. The large power conductors need only be broken under no voltage conditions, and the control could be operated from the bridge where of advantage.

The author was of opinion that for marine propulsion electrical power transmission could only be successfully effected by polyphase alternating currents, with synchronous generators and squirrel-cage induction motors on account of the low cost and weight per horse power, absence of commutators, and high efficiency of these machines. In generators of this type the armature was a stationary closed ring, with the winding embedded in slots round the inner face, inside which the field magnet revolved. The main current was generated in the stationary ring and taken off direct, without any of the intermediary devices necessary when collecting current from a rotating source. The field magnet received its exciting current from a small direct-current machine, mounted on the generator shaft. This current, which only amounted to about 2 per cent. of the generator output, was delivered to the revolving field through simple collecting rings. It was of importance to note the exceptionally high efficiency, light weight, and low steam consumption of such combinations as converters of mechanical into electrical energy. The efficiency varied from 85 per cent in small sets to 98 per cent in large sizes, such as used for traction generating stations; the weight was between 35 lb. and 22 lb. per kilowatt output continuous rating, according to speed and other circumstances; while the steam consumption in 7,500-kilowatt sizes, running at 750 R. P. M., with 160 lb. steam pressure at the top valve, 150 deg. superheat, and exhausting into 27½-in. vacuum, was only 13.5 lb. to 14 lb. per kilowatt-hour, including steam used for auxiliaries.

As regards the induction motor, its powerful starting torque, light weight, simplicity, low cost of construction, mechanical strength, durability, and running characteristics, made it especially suitable for marine work. As there was no commutator and no sparking limit the output could be carried much higher per unit weight than in other machines. These motors could be built for marine work of from 1,000 to 10,000 horsepower continuous rating, weighing 35 lb. to 20 lb. per brake horsepower, with an efficiency of 93 to 97 per cent. Although polyphase motors were termed non-synchronous they always tended toward synchronism, and with squirrel-cage rotors the variation in speed from light to full load seldom exceeded 5 per cent, even in small sizes, and would probably not exceed 1 per cent in large sizes. The main working current passed through the stationary part of the motor only, facilitating strong and reliable construction for the conductors and rendering the machine so simple as to require no skilled and very little unskilled attention with consequent low cost of maintenance.

Assuming a vessel of 4,000 horsepower fitted for electric propulsion with four propellers taking 1,000 horsepower each at 250 revolutions per minute, the motors would be polyphase induction type with sqiurrel-cage rotors and with stators wound for full, half, and quarter speeds. The generating plant would comprise duplicate sets of turbo-alternators and exciters capable together of supplying 3,250 kilowatts, and running at 1,500 revolutions per minute, with 150 lb. steam pressure and 150 deg. Fahr. superheat. These alternators would be two-pole machines, and the motors would be wound for 12-poles, giving a reduction of 6 to 1. For half-speed a second winding would be arranged for 24-poles, giving 12 to 1 reduction with two sets of windings in parallel, and for quarter speed this winding would be arranged for 48-poles, giving 24 to 1 reduction; the synchronous speeds would thus be 250 revolutions per minute for full speed, 125 revolutions per minute for half speed, and 62½ revolutions per minute for quar-

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ter speed.

At full speed of the vessel the propellers would require 4,000 shaft horsepower, and the turbo-generators would be run in parallel delivering 3,250 kilowatts to the motors. The consumption of steam would be 13 lb. per shaft horsepower or 16 lb. per kilowatt hour, equivalent to a total consumption of 52,000 lb. of steam per hour. Compared with propeller turbines the consumption in which, under similar conditions and speed, was of the order of 22 lb. of steam per shaft horsepower or a total of 88,000 lb. per hour for 4,000 horsepower, the saving in favor of electric transmission was no less than 41 per cent. At half speed of the vessel about 600 shaft horsepower would be required, less than half load on one turbo-generator, and this would allow the duplicate set to be shut down. Estimating the motors at 60 per cent efficiency on half speed the generator would deliver 740 kilowatts at its full normal speed, and take 24 lb. of steam per kilowatt hour, equivalent to 17,760 lb. per hour, as against 28,200 lb. for propeller turbines, thus saving at least 37 per cent in steam when the vessel is moving at half speed. The weights of the electrical transmission plant in this example would be:

	Tons.
4,000 B. H. P. at 35 lb. per H. P. developed	62½
Conductors, switch-gear, etc.	6
Two turbo-generators as above	70
Condenser for above	19
Steam piping, etc.	13
Air pump and motor	6
Circulating pump and motor	7½
	184

While the weight of the direct-coupled turbines and part of the propeller shafts, tunnels, etc., including condenser, steam pipes, etc., air and circulating pumps—which would have to be arranged efficiently to deal with the 88,000 lb. of steam—would be at least, taking the speed of the turbines at 250 revolutions per minute, 148 tons, showing that the electrical machinery would be about 25 per cent heavier, but it is here necessary to point out that that only applies to the plant from stop valve to propeller shaft connections.

This comparison does not cover the saving in power and weight of boilers. On the other side of the stop valve the weight of cylindrical boilers (empty), mountings, funnel, forced draught gear, pipework for steam-water and exhaust, pumps, gratings, platforms, etc., is stated to be 180 lb. per indicated horsepower in reciprocating engined ships. Taking a vessel carrying two reciprocating condensing engines developing together 4,000 brake horsepower—equal to 4,700 indicated horsepower at 85 per cent mechanical efficiency—the weight of boiler and stokehold equipment would be 377 tons. At 16 lb. of steam per indicated horsepower, including auxiliaries and losses, the total consumption would be 75,200 lb., or 200 lb. of steam per hour per ton of boiler-room equipment.

At this rate the boiler-room equipment on the electrically equipped vessel, taking 52,000 lb. of steam, would be 260 tons, while for the propeller-turbined vessel the weight would be no less than 440 tons. There would thus be a saving for equal propeller horsepower of 180 tons weight—that is, no less than 40 per cent. Comparing coal consumption, the author took it that, with good Welsh coal, hot feed, and clean flues, it was possible to evaporate 10 lb. of water per pound of coal burnt, and at this rate a turbine-propeller vessel would burn 8,800 lb. per hour, as against 5,200 lb. by the electric-propeller vessel—a saving of 1.6 tons per hour. This represented a saving in dead weight carried of about 230 tons on a sixty days' trip, with correspondingly reduced running cost. Electrical propulsion should be of considerable interest to cargo vessel owners, as not only could dead weight and cost be saved, but the propeller speed could be kept as low as necessary and usual in these slow boats to secure the best economy at the propeller; and it would also be possible further to reduce the propeller speed if necessary to meet practical conditions by slight increase in the weight of the motors only, the generating plant weight remaining the same. The author pointed out that the conclusions deduced should not be considered as perfectly definite, on account of the widely different conditions in practice; but the paper was chiefly put forward to lead naval architects and marine engineers to give serious consideration to the question of electric propulsion.

Reference was made to other systems proposed, and a large number of lantern views and drawings exhibited. The original Dart-Durtnall continuous-current system employed series-wound generators and motors direct-coupled to six propeller shafts, but was for small powers only. In Mr. Parsons' system the exhaust was taken from the main reciprocating engines to drive a low-pressure turbine coupled to an electric generator delivering current to a motor on the engine propeller shaft. Single-phase commutator motors had been proposed in one German and one American system; in the former case with three-phase, and in the latter with single-phase generation, and in one other American proposition three-phase non-synchronous generation was included. A Swiss proposition was to use direct-coupled turbines at the vessel's full speed and a separate turbine driving an electric generator supplying current to electric motors on the main turbine shafts for reducing the vessel's speed or reversing. The reverse, however, in most of these systems was only one-third of full power. The Hart-Durtnall three-phase system, as applied to marine propulsion in conjunction with internal combustion engines, providing a reverse and three ahead speeds with control from the bridge, was referred to, but the author pointed out that until a satisfactory internal combustion engine of large power was produced, the steam turbine would remain the most simple, light, and efficient prime mover.

THE CINCINNATI LAUNCHED.

The new Hamburg-American liner Cincinnati, which is intended for the New York freight and passenger trade, has been launched at the yards of the Schichau Ship Building Co. at Danzig, Germany. She is a vessel of about 18,000 tons, and is to be ready for service in the spring of 1909. The dimensions of the Cincinnati and her sister ship, the Cleveland, also building, are as follows: Length, about 600 ft.; width, about 65 ft.; height, from water line to upper deck, about 55 ft. They are built of the best steel and are provided with five steel decks and a double bottom extending the entire length of the ship, which latter is sub-divided into numerous water-tight chambers, and the hull itself is divided into 11 water-tight compartments. Two well-balanced high and low presssure engines of the quadruple expansion type, which are supplied with steam from three double and three single boilers, will give these vessels a speed of about 16 knots. They will have the capacity for about 300 first-cabin passengers, 350 second-cabin passengers, 530 third-cabin passengers, and 2,200 steerage passengers, and will have a cargo capacity of about 15,000 tons. The crew will comprise about 360 officers and men.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., launched another of the steel barges which it is building for the Isthmian Canal Commission on Aug. 6.

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ATLANTIC COAST GOSSIP.

Office of the MARINE REVIEW,
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New York City.

The steamship Goldsboro, now at Mobile, is to be discharged under orders from New York. The cargo will be shipped by the Mallory liner sailing from Mobile this week, after which the vessel will be sold for the benefit of all concerned. She is at present undergoing repairs.

The Dominion Line Steamship Southwark, from Montreal for Liverpool, grounded at Bras Point, on the outer edge of Fortneau Bay, while outward bound last week. The passengers and mails were transferred to the steamship Ottawa, the Southwark later being floated. She suffered some slight injuries to her bottom.

Capt. J. W. Hammond, of Philadelphia, has been appointed marine superintendent of the Staples Coal Co.'s fleet of coal carriers, in the place of the late Capt. Cummings.

The Philadelphia Trans-Atlantic Line steamship North Point, from London for Philadelphia, was in collision recently at Gravesend, her bow being stove in above the water line. She is being detained for repairs.

La Savoie, of the French Line, arrived at Havre last week from New York, having broken her shaft and lost her propeller.

Capt. Young, of the Mallory Line steamship San Marcos, reported on arrival at Galveston having spoken the schooner Charles Noble Simmons, from Porto Rico for Baltimore on Aug. 2, flying signals of distress. The schooner, whose rigging was badly damaged, was short of provisions. The San Marcos supplied the necessary provisions and proceeded.

The new German Clyde-built steamer Purelight, designed for carrying oil in bulk, arrived last week at Philadelphia. The Purelight has been built for the Pure Oil Co., and is a steel vessel of 370 ft. in length, 51 ft. beam and 27 ft. depth. She registers 4,430 gross tons.

The American consul general at Halifax has advised the state department of the collision at sea between the American fishing schooner Maggie and May and the German schooner Freya, resulting in the sinking of the schooner with the loss of the captain and eight sailors. The matter has been brought to the attention of the department in order to determine what redress, if any, is possible on the part of the owners of the schooner, Davis Bros., of Gloucester, Mass. The disaster occurred during a heavy fog off the coast of Nova Scotia.

The British steamship Kiora has sailed from Thompson's Point for Colon, with a cargo of supplies for the Isthmian Canal. The supplies consist of steel rails and angles, switches, steel bars and beams, and iron castings. This in addition to 600 tons of dynamite.

The steamship Pleiades, of the Boston Steamship Co., is reported to have been sold to the Hawaiian Development Co., for $280,000.

The steamship Aries, which for more than 40 years has been engaged in the coasting trade, is to be converted into a coal barge. The Aries was owned by the Merchants' and Miners' Co., and lately used by the company as a reserve ship. She has been sold to Fred Cramer, of Philadelphia.

The Aries was a blocade runner during the civil war, being singularly successful during the war and capturing many prizes. For many years she traded between ports along the coast, and was for some time owned by the Winsor Steamship Co. She is reported to have been built in Sunderland, England, the exact time being unknown.

Capt. J. S. Mitchell, who, while commanding the British Yacht Deerhound at the time of the American civil war saved the lives of Capt. Semmes, the commander of the Confederate cruiser Alabama, and a number of the crew, after the fight between the Alabama and Kearsarge and landed the rescued men at Southampton, died at Southampton Aug. 14.

The ship Edward Sewall, from the Hawaiian Islands, arrived at Philadelphia last week in command of Capt. Quick, after a run of four months and seven days. The ship Astral, which left Hilo the same day, has not yet been spoken.

The steamship Valesques, which sails from Brooklyn on Aug. 20, will carry the members of one of the most important astronomical expeditions ever sent out from the United States. An observatory will be erected in Argentina, South America, most of the more delicate instruments and material being shipped by the Valesques. The vessel is due to arrive at Buenos Ayres about Sept. 16.

The steamer Henry E. Eaton, which runs daily between Eastport, Me., and Calais, ran on a sunken ledge at the mouth of the St. Croix on Aug. 15. The steamer, which struck the ledge in a dense fog, was beached about a mile from the scene of the accident. The passengers were safely landed in the boats of the Eaton.

Capt. John McCarty, of the ferryboat Thomas S. Brennan, whose license was revoked some time ago by the board of steamboat inspectors, has, as the result of an appeal, had all charges brought against him dismissed and his license restored.

RETIREMENT OF ADMIRAL EVANS.

Rear Admiral Robley D. Evans, until recently commander-in-chief of the Atlantic battleship fleet, was retired from the active service Aug. 18, under the age limit, he having on that date reached the age of 62.

Admiral Evans has held nearly every important command in the American navy and no other naval officer has seen so much of real service. In addition to his participation in the civil and Spanish wars, he has since the latter conflict been commander-in-chief of the Asiatic, now combined with the Pacific fleet and still later was in command of all the vessels of the Atlantic fleet.

It was in this capacity that Admiral Evans achieved his greatest fame, owing to the great cruise from the Atlantic to the Pacific, which was undertaken and brought to a successful conclusion by him in spite of physical disabilities, which at last forced him to relinquish the command.

"Fighting Bob" Evans, as he is so frequently called by his comrades of the navy and the American people at large, is at present at Lake Mohonk, N. Y., with his family, and on Tuesday, when his 48 years of service terminated, he was tendered a celebration which included the presentation of a loving cup provided by popular subscription. While unable to use one foot because of injuries received in the Civil war, and which compelled him to leave his fleet at San Francisco, Rear Admiral Evans is mentally alert and vigorous, with prospects of many years before him.

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QUESTIONS FOR MASTERS AND MATES.—NO. 9.

131. What would be the effect were you to turn a suspended magnetic needle end for end, and then let go of it?

132. Tell how to make iron filings adhere to a bar of soft iron by the aid of a bar magnet.

133. Bring a piece of soft iron into contact with the pole of a bar magnet, and dip the end of the soft iron into iron filings. What is the result?

134. Remove the piece of soft iron from the magnet, and what is the effect?

135. What is a "magnetic chain?"

136. Explain how one can be made.

137. What kind of magnetism is this?

138. Explain how repulsion is possible to be converted into attraction?

139. What would be the effect if two magnets of unequal size be brought into contact with each other?

140. What would be the effect of two magnets of about the same size if their like poles were brought together?

141. What would be the effect if their unlike poles were brought together?

142. Explain why when a bar magnet is broken two magnets are formed.

143. What is induced magnetism?

144. What is the difference between permanent magnetism and induced magnetism?

145. What is meant by the variation needle?

ANSWERS TO QUESTIONS FOR MASTERS AND MATES.—NO. 9.

131. It would return to the position it first occupied in line with the magnetic meridian.

132. Make a temporary magnet of the bar of soft iron by bringing it into contact with a permanent magnet causing magnetism by induction.

133. Soft iron becomes magnetic by induction and the filings adhere to it.

134. Iron loses its magnetism and the filings fall off.

135. A number of magnets end to end or a number of pieces of soft iron end to end with a permanent magnet.

136. Hold up a magnet and put a number of small pieces of soft iron end to end to it, they become magnetic through induction.

137. Magnetism by induction.

138. By having magnets of unequal size and power. The more powerful one will overcome the repulsion of the like pole of the smaller and convert it into attraction.

139. Repulsion in the smaller one would be converted into attraction.

140. The magnetism of each would be increased, there would be again as much.

141. They would neutralize each other.

142. It is impossible to have a magnet with only one pole.

143. Temporary magnetism imparted to soft iron by the influence of a permanent magnet.

144. Permanent magnetism is not lost on the removal of the magnetizing power but stays with the article magnetized permanently. Induced magnetism is temporary and is lost on the removal of the inducing magnet.

145. A needle that obtains its directive power from the horizontal force of the earth's magnetism. One that moves in the horizontal plane, such as the compass needle.

QUESTIONS FOR WHEELSMEN AND WATCHMEN.

571. How many feet in 145 fathoms?

572. How many fathoms in 180 ft.?

573. How many marks on the hand lead line?

574. How many deeps?

575. Name the marks.

576. Why are they called marks?

577. Is 6 fathoms a mark or a deep?

578. How do you turn nautical miles into statute miles?

579. How many feet in a nautical mile?

580. How many pounds in a short ton?

ANSWERS.

571. 870 ft.

572. 30 fathoms.

573. 9 marks.

574. 11 deeps.

575. 2, 3, 5, 7, 10, 13, 15, 17 and 20 fathoms.

576. Because these fathoms are marked.

577. A deep.

578. Multiply nautical miles by 1.15.

579. 6,080 ft.

580. 2,000 lbs.

ITEMS OF GENERAL INTEREST.

The first step in the direction of the construction of the great inland waterway which is to connect Boston with the Carolinas and possibly with Florida, was taken Aug. 5, when orders in seven cases of condemned lands for right of way from Pamlico Sound to Beaufort harbor, were signed by the judge of the federal court for the eastern district of North Carolina. Title has also been taken for all the other lands required other than those which had to be condemned. This particular section of the great waterway will include 16 miles of cut and will traverse in addition the Pamlico river, Neuse river, Core creek and out into Beaufort harbor. Congress at its last session appropriated $550,000 with which to begin the work.

The Maine Steamship Co., of New Jersey, of which the entire capital stock is owned by the New York, New Haven & Hartford railroad, has defaulted on its bond interest due Aug. 1, and a committee has been appointed for the protection of its bondholders. The Maine Steamship Co., of New Jersey, is a holding company owning the entire stock of the Maine Steamship Co., of Maine, which operates steamboats between New York and Portland, and the stock of the Maine company is pledged as security for the bonds of the New Jersey corporation. The bonds on which interest has been allowed to default amount to $1,000,000, of which $773,000 is in the hands of the public and the remainder in the treasury of the company.

Considerable discussion has been aroused in England by rumors which have been afloat that the three Dreadnought battleships ordered for Brazil two years ago are to be purchased for the German navy. It has been stated that these ships, all of which will be completed by next fall, are to be conveyed to the German government by the government of Brazil for the sum of $30,000,000. Reports have been current to the effect that the battleships were being constructed for the Japanese navy under a secret agreement with Brazil, as it was not understood how a power of the rating of Brazil could need such formidable engines of war. The English public is now demanding that the admiralty purchase the vessels to prevent them from falling into the hands of the Germans.

The department of public works of the state of New York is calling for bids for the construction of certain portions of the barge canal as follows: Contract 20 calls for the dredging of the channel of the Mohawk river between Rexford Flats and Little Falls, and Contract 66, which provides for excavation and lock work at Lockport.

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MERCURIAL AND ANEROID BAROMETERS.

Weight of Air.—Although invisible and comparatively light, air is a veritable substance and has appreciable weight. This is made evident by the resistance it offers to the movements of an open fan, and, when it is itself in motion, by its effects upon the sails of a ship or a windmill. If a hollow glass globe holding a cubic foot is emptied of air and carefully weighed at sea level, on admitting the air again it will be found to weigh about 1¼ ounces more than

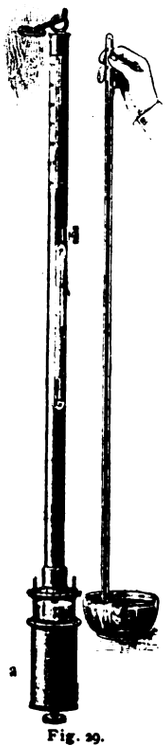

Fig. 29.

before. This increase is manifestly the weight of a cubic foot of air. An equal bulk of water weighs about 840 times as much. It is gravitation, or the weight of air, which holds the atmosphere to the earth, just as it is the weight of water which holds the oceans in their beds.

Pressure.—The weight, not of a cubic foot of air, but of the whole atmosphere resting upon any specified area, creates thereon a presssure called the atmospheric pressure.

The barometer is an instrument used to ascertain the amount of atmospheric pressure. The barometer in most common use consists of a glass tube about 3 ft. long, closed at the upper end and open below. The air being entirely extracted from the tube, the open end is immersed in a little basin of mercury (Fig. 29b). It is evident that the atmospheric pressure upon the exposed surface in the basin will force a column of mercury up into the vacuous tube, until the weight of the column becomes just equal to that pressure. When suitably mounted, as in Fig. 29a, there is attached to the tube a graduated scale for ascertaining the length of the mercurial column. The length of a column required to balance atmospheric pressure at sea level is found to vary constantly, but on the average it is about 30 in. long; and since a column of mercury 1 in. square and 30 in. long weighs 14¾ pounds, it follows that this is the average weight, or pressure, of the atmosphere on each square inch of the earth's surface, at sea level.

Density.—Being gaseous, air is elastic; even a slight pressure squeezes it into less space and renders it denser, but upon removal of pressure, it immediately expands and becomes less dense. As every portion of the atmosphere sustains the pressure of the portion over it, the lower part is more heavily compressed than the upper. For this reason the atmosphere is densest near sea-level, and becomes less dense as the distance above that level increases.

On the mercurial barometer the scale is spaced off in inches, whence is derived such terms as "the barometer stands at 30 in." etc., meaning in this instance that the level of the mercury in the glass tube is opposite the 30-in. division of the scale.

It should be borne in mind that at sea level the pressure on the atmosphere on every square inch of surface is nearly 15 lbs., or nearly one ton on the square foot, and is exerted equally in all directions—upwards, downwards and sideways. The pressure of the atmosphere having thus been demonstrated it merely remains to show the particular mode of action on the barometer. Take a glass tube about 33 in. in length, hermetically sealed at one end. Fill this with pure mercury, and have some more handy in a small vessel, such as a teacup. Press the finger tightly over the open end to act as a stopper, and invert the tube, placing the end covered by the finger in the cup containing the mercury, and when well below the surface, remove the finger. The first assumption would be that all the mercury would instantly flow into the cup. Not so, however, the quicksilver will only fall in the tube —leaving a vacant space in the upper end—till the weight of the column is balanced by the atmospheric pressure on the liquid metal in the cup. It is evident that there can be no downward pressure on the mercury in the tube, since the tube is tightly closed at its upper end. The column of mercury remaining within it will be found to be about 30 in. in height, and would be equal to the weight of a column of the atmosphere having the same sectional area as the interior of the tube.

To put this more plainly—supposing the glass tube to have an internal transverse area exactly 1 sq. in., and that the height of the column was ascertained to be 30 in., this would give the contents as 30 cu. in. Now, 1 cu. in. of mercury at an atmosphere of 60 degrees (Fahr.) weighs 0.491 of a pound, so that the total weight of the mercury in the tube would be equal to 30 x 0.491, or 14.73 pounds, which would also be the weight of a column of atmosphere indefinitely high, having a similar sectional area of 1 sq. in. Air, even in small quantities, is capable of being weighed; with barometer at 30 in., and thermometer at 62 degrees Fahr., 100 cu. in. of dry air will weigh nearly 31 grains.

The student must understand that the mercury does not rise and fall in the tube merely by its own expansion or contraction due to temperature, but that it is forced to rise, or suffered to fall, according to the varying pressure of the atmosphere; and that the scale readings represent inches and decimal parts of an inch, and not degrees, as some call them, especially so on the aneroid barometer, because of its circular dial plate containing the scale. The scale represents inches in both cases, only the space between the barometric inch on the aneroid is not a linear inch, but by its mechanical arrangement it is made to travel an inch during the same time that it takes the mercury in the mercurial barometer to travel this distance. In other words its mechanism is regulated to the mercurial instrument, and by which it is at all times compared and set.

Since atmospheric pressure decreases with an increase of elevation, the mercury in a barometer falls as the instrument is carried upward. To moderate elevations, the rate of this fall is about 1/10 of an inch for each 100 ft. of ascent. The barometer may therefore be used to determine the relative heights of two or more places. The depth of a mine may of course be measured in the same manner. In a case of this kind the mercury would go up.

If water were used in a barometer

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instead of mercury, the tube would require to be about 36 ft. in height. Water being 13.6 times lighter than quicksilver, would be forced proportionately higher, and when the mercurial column stood at 30 in., the water column would have a height of nearly 34 ft. It is due to this fact that we are able with a common two-valve suction pump to lift water out of a well from a depth of about 30 ft.

The barometer measures the weight or pressure of the air. When the barometer continues steady settled weather (good or bad) may be anticipated; but if unsteady a change is promised. A sudden rise is nearly as bad as a sudden fall, as it proves that the equilibrium of the atmosphere is unsettled. When the mercury in the cistern is pressed down by the atmosphere, the mercury rises in the exhausted tube, but when the mercury in the cistern rises on account of diminished pressure of air the mercury in the tube falls.

The falling of the mercury generally indicates the approach of foul weather; a sudden fall denotes the coming of the storm. The rising of mercury indicates the approach of fair weather or the "clearing up" of a storm.

Sometimes the "barometer falls" and the looked-for storm does not appear. In such a case, it should be remembered that the barometer announced only a diminution of atmospheric pressure, and that we, influenced by experience, inferred the coming of a storm. Barometric declarations are reliable; inferences from those declarations are subject to error.

In the aneroid (dry) barometer the atmosphere presses on a thin metal box from which the air has been extracted and which is kept from collapsing by a spring. To this box is secured by a mechanical arrangement the index hand that moves around the dial or face of the barometer. When the atmospheric pressure increases, a spring acting on a lever turns the hand to read high, but when the pressure decreases, the hand turns to read low.

The aneroid consists of a flat cylindrical vacuum box, fixed at the center to a foundation plate, while at the center of the upper surface is a metallic pillar, which acts upon a powerful steel spring. The varying atmospheric presssure causes the surface of the vacuum-chamber to rise and fall as already stated; these movements are transmitted to the spring, and thence by two levers to a metallic axis.

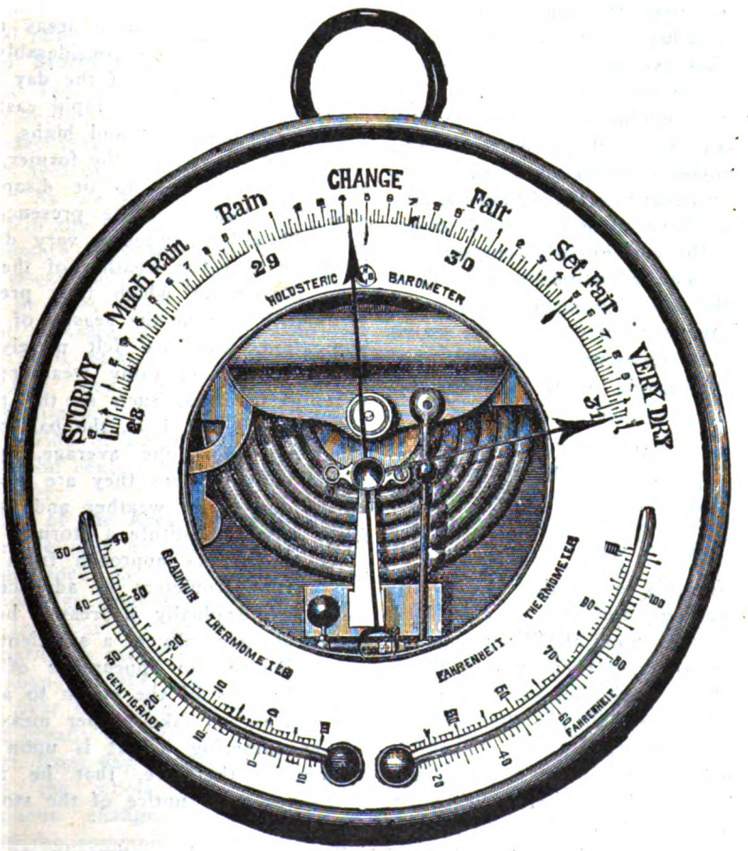
From the latter rises a lever, to whose extremity a chain is attached, which turns a drum, the axis of which bears the index-needle. A firm spiral spring keeps the chain constantly in proper tension. By this arrangement of mulitplying levers, a very small movement of the surface of the vacuum chamber causes a large deviation of the needle; one-two-hundredths of an inch causing it to move through a space of 3 in.

The circular graduated scale on the dial plate of the aneroid admits of it being read by the hand or indicator, and also to be set by the set hand. This set hand is from whence the indicator is read, and shows the changes in the atmosphere at any time. The set hand can be made to coincide with the indicator at pleasure. For instance, the indicator is on 30, and it is desired to tell within the next few hours what changes take place in the atmospheric weight. The set hand is made to coincide with the indicator, or in other words it is made to read the same as the indicator. The change or fluctuations will be the amount that the indicator has moved from the set hand. This set hand has nothing to do with the working mechanism of the instrument, but is merely made to move, or revolve, on the outside face of barometer.

The scale is divided to two hundredths of an inch, that is, the smallest divisions are 0.02 of a barometric inch; you will notice that there are five of these graduations between the 1, 2, 3, etc., divisions; 1, 2, 3, etc., represent 0.1 0.2, 0.3, etc., inches, and are read to hundredths, that is, 0.1 is called 0.10; 0.2 0.20, etc. The indicator in the above barometer is at 29.42, meaning the pressure of the atmosphere. The set-hand is on 31.06 in. of atmospheric pressure.

On the mercurial the scale is spaced off in inches and hundredths of an inch in the same manner, and they conform to linear measure. Although the distance of an inch of air pressure on the aneroid scale is not a linear inch it nevertheless represents an inch on the mercurial scale to which it has been adjusted.

The aneroid may be hung up or placed flat on its back, but changing from one position to another ordinarily changes the readings sensibly, and it therefore should be kept, while in use, constantly in its selected position and place. An additional merit which the aneroid possesses is, that



MECHANISM OF THE ANEROID.

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being more sensitive than the mercurial one, its variations take place simultaneously with their causes. Its mechanism, however, like other pieces of mechanism, is liable to derangement, which can only be detected by frequent comparison with a correct standard.

The aneroid barometer is not an independent instrument from the mercurial barometer by which it was originally set by the application of a small turnscrew gently to the screw head at the back. They require adjustment occasionally in the same way that they are in the first place set.

In ascending or descending elevated lands, the hand of the aneroid may be seen to move like the hand of a watch, showing the height above the level of the sea, which latter is adopted as the datum line for barometrical measurements. In ascending or descending allow 0.0011 of an inch for each foot.

If the instrument is on shipboard, and will remain undisturbed in its place, then the most important point is to get its correction for temperature. The correction for temperature in the mercurial barometer is a known quantity, and a table short enough to be convenient can be used, but in the aneroid it must be found for each instrument. The temperature of the aneroid may be obtained approximately by placing it in the coldest temperature, say about half an hour. If possible, this operation should be repeated. During a stable condition of the air, if a mercurial or other aneroid can be set and kept at an uniform temperature during the time, it will correct for any change of pressure, and fewer trials will be required.

The known expansion and contractions of metals under varying temperatures might cause a doubt as to the accuracy of the aneroid under such changes; but the inventor has met this difficulty by introducing into the vacuum box a small quantity of gas as a compensation for the effects of heat and cold; the gas in the box changing its bulk on a change of temperature, is intended to compensate for the effect on the metal of which the aneroid is made.

The barometer requires careful handling, and should not be subject to unnecessary knocks and shocks. It should be secured to the side of the cabin, in a vertical position, where neither the sun's rays, nor a fire, nor any local cause of heat or cold may be likely to affect it. It should be kept in about the same temperature as near as possible, so that the changes in the air pressure will readily influence it.

As the delicate mechanical parts are liable to suffer from rust, wear and tear, and other causes, it should, as a precaution, be occasionally compared with a standard mercurial barometer. The hydrographic offices and weather bureau offices on the lakes compare and verify, as well as to set the aneroid by their standards free of charge.

The comparison should be made with the aneroid in two positions, one in the upright position, or as it would when suspended; and the other on its flat, as it would be when lying on a table. In nearly every instance there is a difference.

Nearly all lake vessels are equipped with aneroid barometers and thermometers, and it requires but a brief period of observation with these two instruments to enable the mariner to keep himself informed at all times of the approach of any extensive atmospheric disturbance likely to endanger his vessel.

In order to use the barometer intelligently as a means of forecasting the weather for any region, it is necessary to have a knowledge of the mean or average barometric pressure prevailing over the region under ordinary weather conditions. All of the great lakes are at a considerable elevation, in consequence of which the barometric readings are considerably less than the readings at sea level. The pressures noted upon the daily weather maps of the United States weather bureau have all been reduced to sea level by the addition of a certain correction. The elevation of each lake above the sea, the mean actual reading of the barometer, and the value of this correction under ordinary conditions are given in the following table[1]:

	Above sea level, ft.	Mean barometric pressure in.	Correction, inches.
Lake Superior....	602	29.30	0.65
Lake Michigan....	581	29.38	0.62
Lake Huron.....	581	29.38	0.62
Lake Erie	573	29.39	0.61
Lake Ontario.....	247	29.73	0.27

It is for this reason that the barometric readings for the several lake stations given upon the daily weather map are so much greater than those recorded by marine observers on the lakes. Another point in this connection is that the words "stormy," "change," etc., upon the face of the aneroid are applicable, if applicable at all, only at sea level. They are therefore worse than useless when the aneroid happens to be used in the lake region, or, indeed, at any point differing much from sea level.

As long as the barometer continues to read within a few hundredths of the average pressure, no decided change in the weather may be anticipated. It is, however, when the pressure starts to rise or fall that the indications of the instrument become of value, as betokening approaching changes, a rise being apt to be followed by an improvement in the general weather conditions, a fall by the reverse. Should the fall continue, and be accompanied by other symptoms, such as a southeasterly wind and an increase in temperature, it is safe to count upon a period of stormy weather.

Nature and Cause of Storms, and Barometric Changes Attending Them.—Upon the weather map published for each day by the United States weather bureau, there will in general appear one or more approximately circular areas, marked "low," while others, of rather more irregular outline, will be marked "high," the two alternating, one with the other. The first implies that the reading of the barometer within the area indicated is below the average, the second, that it is above it. If we examine a number of these charts from day to day in succession, we will note that the position of the center of each of these areas upon any particular day is considerably to the eastward of that of the day previous; i. e., there is a rapid easterly motion of both lows and highs, continuing, in the case of the former, until they either fill up or disappear over the Atlantic. The presence of these "lows" exercises a very direct influence over the weather of the region throughout which they prevail. Ordinarily, during the season of lake navigation, they are felt merely as periods of warm rainy weather; in exceptional cases, such as the present, they deepen, i. e., the barometer falls far below the average, under which circumstances they are attended by the rough weather and heavy gales which constitute a storm.

As these lows approach from the westward, barometers in advance of them are gradually depressed below the mean, generally at a sufficient interval before the appearance of the worst features of the storm to allow the mariner to take proper measures for encountering it. It is upon the barometer, therefore, that he must mainly rely for notice of the storm's approach.

Storms are due primarily to the formation and persistence of areas of

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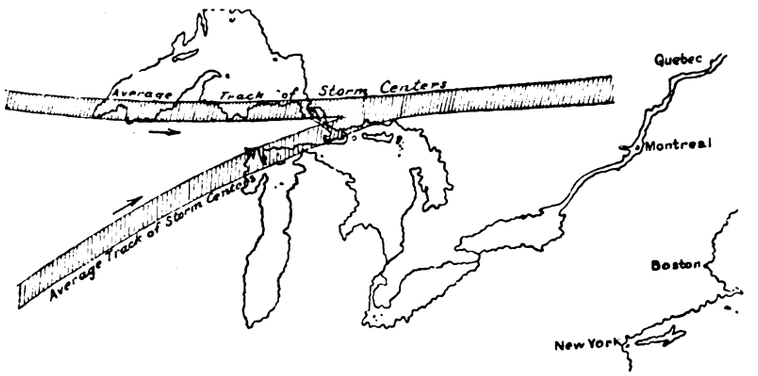

Figure 1.

low barometer. Under ordinary circumstances, the reading of the barometer differs but little from the mean. The atmospheric pressure over a certain region having fallen below the average, air rushes in from all sides to restore the equilibrium, just as water rushes in from all sides to fill a vacant space in its midst. Under certain complicated conditions the influx of this new air, instead of filling up the area of low barometer, serves only to increase it, the depression becomes deeper, the influx of air becomes stronger, and a storm is established. As the storm gains in intensity, the area of low barometer assumes a roughly circular shape, and attains a diameter varying from 200 to 500 miles, and even greater.

The Storm Center.—The point of lowest barometer is known as the storm center, inasmuch as it generally coincides very nearly with the center of the area over which the storm prevails. As we go outward from the center in any direction, the atmospheric pressure increases and the barometer rises; and if we draw the isobars, or lines along which the barometric pressure is the same, say for 29.00, 29.10, 29.20, etc., inches, we will find that they form closed curves, nearly circular or elliptical in shape, one outside of the other, having for a common center the point of lowest barometer.

Shape of the Area at Low Pressure.—For the sake of simplicity, in what has preceded, the outline of the depression has been described as circular. In point of fact, however, this assumption is rarely fulfilled, the general shape of the isobars, especially those near the center, being oval, differing greatly in different storms, and, in fact, from day to day in the same storm, the whole area undergoing continuous change. The grouping around the common center is furthermore by no means symmetrical, the isobars being very much closer together in certain directions from the center than in others, which is equivalent to saying that the rise of the barometer as we go from the storm center in that direction is very much more rapid than in others; and just as water runs down a steep hill much more rapidly than it does down a gradual one, so the air runs down this steep barometric slope more rapidly than it does down the gradual, the common experience being that the winds are much stronger in that portion of the storm where the isobars are crowded together than where they are widely separated.

Barometric Definition of a Storm.—The preceding description may be summed up in the following general terms: Barometrically considered, a storm is an eastward-moving oval-shaped depression, several hundred miles in diameter, the depression being deepest (barometer reading lowest) near the center, and sloping upwards from the center on all sides.

Wind and Weather in the Various Parts of the Depression.—Observation has shown that there are certain conditions of wind, cloud, temperature, etc., which are peculiar to certain portions of these depressions, the same conditions being always encountered in the same portion. Of no feature of the weather is this so true as of the direction of the winds around the center of the storm, and it is by carefully observing this direction, and the manner in which it changes—the "shifts" of the wind—added to the behavior of his barometer, that the mariner is enabled to decide whether he is in advance of the storm, with the latter bearing down full upon him, or in the rear, having already withstood its worst severity; whether he is to the north of the track, or to the south; and if compelled to heave to, whether they must do so on the port tack or the starboard, in order to escape the danger of being overborne by the heavy seas, or struck aback by some sudden squall of wind.

Air is like water and just as water flows from a higher to a lower level, so air always flows from a region of high barometer to a region of low. Accordingly, as soon as a barometric depression is formed at any point, there is a tendency of the air to rush in from all sides towards that point, until the depression is filled up and the barometric level is restored. If then, barometric differences were the only thing to be considered, we would find surrounding a storm a series of winds, of force proportioned to the steepness of the side of the depression, all blowing straight toward the center, just as the spokes of a wheel are all directed towards the hub. This simple condition of things is never realized, owing to the fact that, in the first place, the storm center itself is in rapid motion, and a wind constantly directed towards this center would therefore of necessity be continually shifting and in the second place, to the fact that all winds in the northern hemisphere, owing to the rotation of the earth on its axis, undergo a constant deflexion towards the right. Under these two influences, the wind, instead of blowing directly towards the storm center along straight lines, follows a constantly incurving path. In the northern hemisphere, we have therefore the following law governing the "Rotation of the Winds":

Around a center of low barometer, the winds circulate in a direction contrary to the motion of the hands of a watch.

To the east, then, in advance of a barometric depression, southerly and southeasterly winds will thus prevail, marking the storm's approach. To the west, in the rear, northerly and northwesterly winds, marking its departure. North of the center, we have easterly and northeasterly winds; south of the center, westerly and southwesterly.

This movement of the air around the center is well illustrated by the discharge of water from a wash-bowl through a central opening in the bottom, first sprinkling the surface of the water with a little powder, in order to make its motion visible. The water soon takes up a spiral movement, and flows around in diminishing circles until the center is reached. Assuming the water current to be wind, it is seen that a ship involved in such an aerial flow at sea might have the wind at any quarter, ac-

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cording to her bearing and distance from the center.

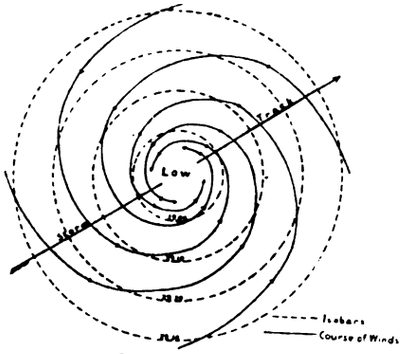

Figure 3

Bearing of the Storm Center From the Observer.—The annexed diagram (Fig. 3) represents this circulation of the winds around the storm center or low. For the sake of simplicity, the storm is made circular, the light dotted lines representing the isobars, the heavy full lines the direction of the winds. The latter is in general inclined two compass points to the left of the former. An observer on the deck of a vessel with his back to the wind will therefore find the storm center, or point of lowest barometer, six points to his left; or, if he face the wind, the center will be 10 points to his right; the two statements being identical. Each of these rules will thus suffice to fix at any moment the direction of the storm center from the observer. It should, however, be borne in mind that the incurvature of the winds towards the center is greater over the land than over the water, and consequently in the case of the great lakes, the proximity of the land will not permit the accuracy in fixing the center which is sometimes attained on the open sea.

The movement of the winds around this storm center in the north Atlantic should here be compared with the typical circulation shown in Fig. 5. Their revolving character in the direction indicated, viz., in the direction contrary to the motion of the hands of a clock, is at once evident. In front or to the east of such an advancing storm, during the fall of the barometer which it occasions, southerly and southeasterly winds are seen to prevail, while during the rise of the barometer succeeding the passage of the storm center, the sailor makes sure of finding northwesterly gales of greater or less severity. As the storm center advances, its circulating system of winds travels with it, the result being that a vessel hove-to to the north or left hand of the track, as at A, for instance, will experience in turn easterly, northeasterly, northerly, and northwesterly winds, the winds thus "backing," i. e., shifting to the west through the north or against the sun; while if her position be to the south, or right hand, as at B, the winds will "veer" or shift to the west through the south or with the sun, the order being southeasterly, southerly, and southwesterly.

For a vessel in advance of the storm and on the track itself the southeasterly wind will hold comparatively steady, and the barometer will fall rapidly until she is overtaken by

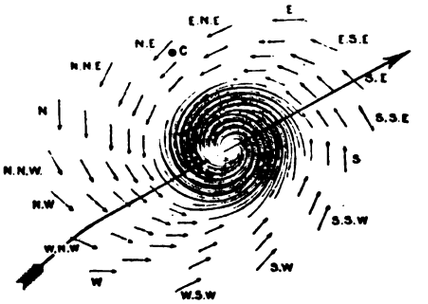

Figure 5.

the center of the depression; then there will be a brief period of stationary barometer, with sudden and irregular shifts, the wind backing and hauling without warning, until the center is past, the barometer starts to rise, and the wind comes out strong from the northwest. With the wind come the heavy seas, from the same general direction, but sometimes lagging behind as much as two or three points. In case of large shifts of the wind, mariners on the ocean prepare

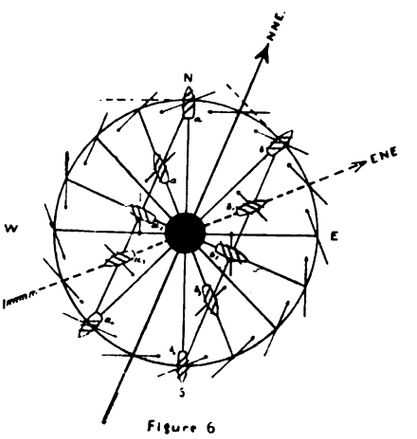

Figure 6

to encounter two seas; one from the new direction of the wind, the other from the old; and should the storm become of such severity that it becomes necessary to heave-to, they always do so on that tack which will cause the wind to draw aft as the storm advances, and thus keep the vessel head-on to the old sea. Which tack that is, whether port or starboard, will be evident from what follows.

Management of the Vessel and Rules for Heaving To.—Fig. 6 represents a storm, whether on the ocean or on the great lakes. For simplicity the general form is made perfectly circular, and the winds are made to incurve two points everywhere. Let us suppose that this storm is advancing about NNE, in the direction of the long arrow, drawn in heavy, full line. Then the ship at *a* has the wind at ENE; she is to the left of the track, or technically, in the left semicircle. The ship at *b* has the wind at ESE, and is in the right semicircle. As the storm center advances along the heavy line, maintaining its area and shape, these ships, if lying to close-hauled, take the successive positions a_1, a_2, etc., b_1, b_2, etc., respectively. The wind of ship *a* shifts to the left, as shown by the arrows; so in lying to on the starboard tack, as shown, her wind will draw ahead, and she may be struck aback, for the shifts are sometimes sudden and very heavy. Since the sea changes less rapidly than the wind, the old sea will draw aft as the ship falls off; she runs, therefore in addition to the risk of being taken aback, that of getting stern-on to the heavy sea, a position of great danger, unless driving fast before it. Evidently ship *a* should be laid to on the port tack in the left semi-circle, in order that the wind may draw aft, and that the ship, in coming up to the wind, shall keep head-on to the old sea.

The other ship, *b*, laid to in the right semi-circle, will have shifts of wind to the right, and being laid to on the starboard tack, her wind in that semi-circle will draw aft, as shown. As she comes up to the gradually shifting wind she will likewise come head-on to the old sea. Plainly, then, *b* is on the proper track. Hence we have the rule: In the left semicircle, with respect to the storm track, the wind shifts to the left lie to, if at all, on the port tack (left tack). In the right semicircle the wind shifts to the right lie to, if at all, on the starboard tack (right tack).

(To be continued.)

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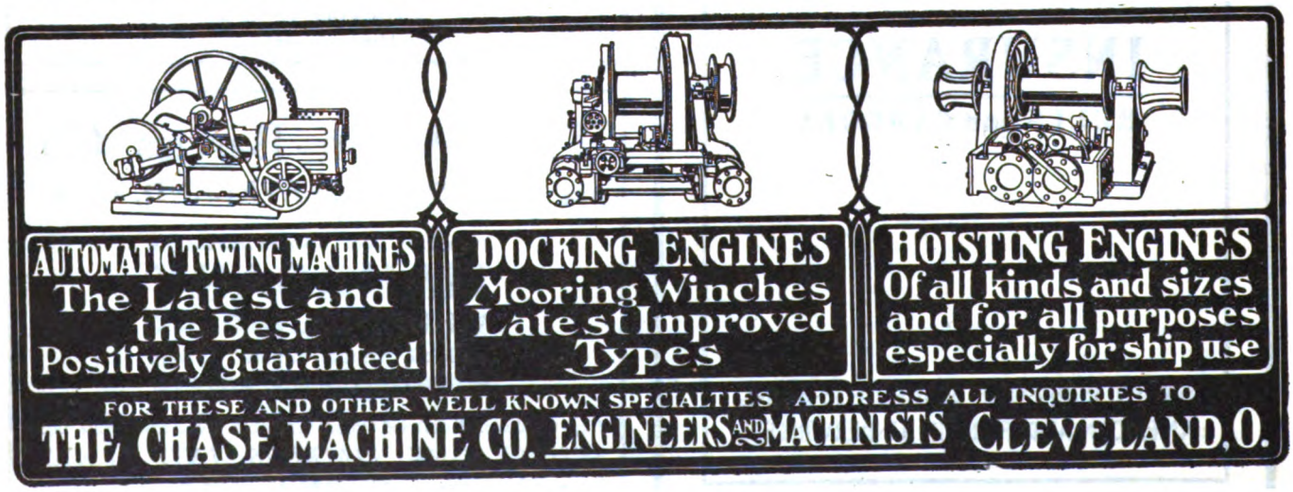
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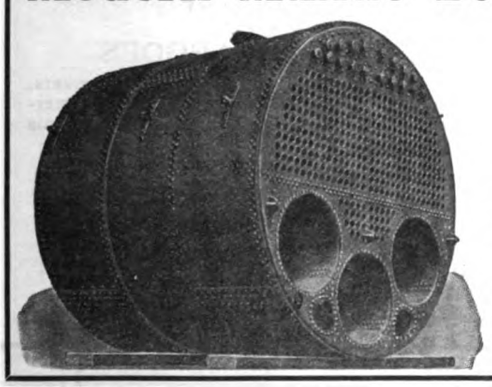

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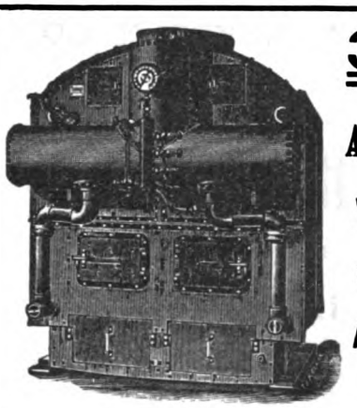

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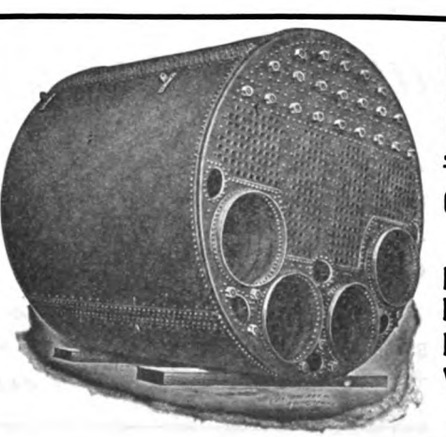

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MacDonald, Ray G., Chicago, Ill.
Marshall, Alexander, Duluth, Minn.
Shaw, Warren, Cady & Oakes, Detroit, Mich.

BAROMETERS, GLASSES, ETC. (Marine).

Ritchie & Sons, E. S., Brookline, Mass.

BARS (Iron or Steel—Hollow Staybolt).

Falls Hollow Staybolt Co., Cuyahoga Falls, O.

BELLS (Engine Room Telegraph Call, Etc.).

Cory & Son, Chas., New York, N. Y.

BLOCKS, SHEAVES, ETC.

Boston & Lockport Block Co., Boston, Mass.

BOATS (Builders).

Drein, Thos., & Son, Wilmington, Del.
Truscott Boat Mfg. Co., St. Joseph, Mich.

BOILERS.

Almy Water Tube Boiler Co., Providence, R. I.
American Ship Building Co., Cleveland, O.
Atlantic Works, East Boston, Mass.
Briggs, Marvin, New York, N. Y.
Chicago Ship Building Co., Chicago, Ill.
Copeland Co., E. T., New York.
(Copeland Scotch Improved.)
Cramp, Wm., & Sons, Philadelphia, Pa.
Delany, P., & Co., Newburgh, N. Y.
Detroit Ship Building Co., Detroit, Mich.
Fletcher, W. A., & Co., Hoboken, N. J.
Fore River Ship Building Co., Quincy, Mass.
Great Lakes Engineering Works, Detroit, Mich.
Griscom-Spencer Co., New York, N. Y.
Johnston Brothers, Ferrysburg, Mich.
Kingsford Foundry & Machine Works, Oswego, N. Y.
Maryland Steel Co., Sparrow's Point, Md.
Marine Iron Works, Chicago.
Milwaukee Dry Dock Co., Milwaukee, Wis.
New York Ship Building Co., Camden, N. J.
Quintard Iron Works Co., New York, N. Y.
Roberts Safety Water Tube Boiler Co., New York, N. Y.
Superior Ship Building Co., Superior, Wis.
Toledo Ship Building Co., Toledo, O.

BRASS GOODS.

Michigan Lubricator Co., Detroit, Mich.
Penberthy Injector Co., Detroit, Mich.

BRIDGES.

Scherzer Rolling Lift Bridge Co., Chicago, Ill.

BUCKETS (Ore and Coal).

Brown Hoisting Machinery Co., Cleveland, O.
Hayward Co., The, New York, N. Y.
Huntsbery, H. E., Cleveland, O.

BUOYS, BOATS, PRESERVERS, ETC. (Life).

Armstrong Cork Co., Pittsburg, Pa.
Drein & Son, Thos., Wilmington, Del.
Kahnweiler's Sons, David, New York, N. Y.
Lundin, A. P., New York, N. Y.
National Cork Co., Brooklyn, N. Y.

BUOYS (Gas).

Safety Car Heating & Lighting Co., New York, N. Y.

CANVAS.

Baker & Co., H. H., Buffalo, N. Y.
Upson-Walton Co., Cleveland, O.

CAPSTANS.

American Ship Windlass Co., Providence, R. I.
Chase Machine Co., Cleveland, O.
Dake Engine Co., Grand Haven, Mich.
Hyde Windlass Co., Bath, Me.
Marine Iron Works, Chicago, Ill.

CAPSTANS (Steam).

Chase Machine Co., Cleveland, O.

CASTINGS (Brass and Bronze).

Griscom-Spencer Co., New York, N. Y.
Cramp, Wm., & Sons, Philadelphia, Pa.
Fore River Ship Building Co., Quincy, Mass.
Great Lakes Engineering Works, Detroit, Mich.

CASTINGS (Steel).

Otis Steel Co., Cleveland, O.

CEMENT. (Iron for Repairing Leaks.)

Smooth-On Mfg. Co., Jersey City, N. J.

CHAINS.

Seneca Chain Co., Kent, O.

CHANDLERS (Ship).

Baker, Howard H., & Co., Buffalo, N. Y.
Great Lakes Supply Co., Buffalo, N. Y., and Duluth, Minn.
Griscom-Spencer Co., New York, N. Y.
Upson-Walton Co., Cleveland, O.

CHARTS.

Penton Publishing Co., Cleveland, O.

CIRCULATORS (Automatic).

Copeland Co., E. T., New York, N. Y.

CLOCKS AND CHRONOMETERS (Marine).

Ritchie, E. S., & Sons, Brookline, Mass.

CLOTH (Waterproof).

Bunker, E. A., New York, N. Y.

COAL (Producers and Shippers).

Hanna, M. A., & Co., Cleveland, O.
Lorain Coal & Dock Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
Pittsburg Coal Co., Cleveland, O.
Toledo Fuel Co., Toledo, O.

COMPASSES.

Ritchie, E. S., & Son, Brookline, Mass.

COMPOUND (Boiler).

Bird-Archer Co., New York, N. Y.

COMPOUNDS (Lubricating).

Cook's Sons, Adam, New York, N. Y.

CONDENSERS.

Great Lakes Engineering Works, Detroit, Mich.

CONTRACTORS (Dredging).

Breymann & Bros., G. H., Toledo, O.
Buffalo Dredging Co., Buffalo, N. Y.
Dunbar & Sullivan Dredging Co., Buffalo, N. Y.
Great Lakes Dredge & Dock Co., Chicago, Ill.
Northern Dredge Co., Duluth, Minn.
Starke Dredge & Dock Co., C. H., Milwaukee, Wis.
Sullivan, M., Buffalo, N. Y.

CONTRACTORS. (Pile Driving and Submarine.)

Buffalo Dredging Co., Buffalo, N. Y.
Dunbar & Sullivan Dredging Co., Buffalo, N. Y.
Great Lakes Dredge & Dock Co., Chicago, Ill.
Parker Bros. Co., Ltd., Detroit, Mich.
Starke Dredge & Dock Co., C. H., Milwaukee, Wis.
Sullivan, M., Buffalo, N. Y.

CONTRACTORS (Public Work).

Breymann Bros., G. H., Toledo, O.
Buffalo Dredging Co., Buffalo, N. Y.
Dunbar & Sullivan Dredging Co., Buffalo, N. Y.
Griscom-Spencer Co., New York, N. Y.
Great Lakes Dredge & Dock Co., Chicago, Ill.
Starke Dredge & Dock Co., C. H., Milwaukee, Wis.
Sullivan, M., Buffalo, N. Y.

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